OCTOBER 16, 1959 ONE SHILLING AND SIXPENCE

THE AEROPLANE and ASTRONAUTICS

COMMERCIAL AIRCRAFT NUMBER

A.W.660

Air Transportation of bulky equipment is vital in this missile age. Powered by four Rolls-Royce Dart engines, the AW.660 cruises at 300 m.p.h. and can carry over 13½ short tons of the most bulky equipment needed by a modern fighting force. The wide, fully-pressurised fuselage will take armed troops, para-troops, radar equipment, guided weapons, wheeled vehicles and all the necessary stores of a mobile military unit. The Beaver Tail rear doors may be opened in flight for supply-dropping by parachute.

Adopted by R.A.F. Transport Command.

HAWKER SIDDELEY AVIATION, 32, DUKE STREET, ST. JAMES'S, LONDON, S.W.1.

These Service Aircraft...

GNAT · HUNTER · SWIFT · SCIMITAR

SEA VIXEN · SEA HAWK · NA39 · LIGHTNING

GANNET · VALIANT · VICTOR · VULCAN

...all rely on Rotax generating systems

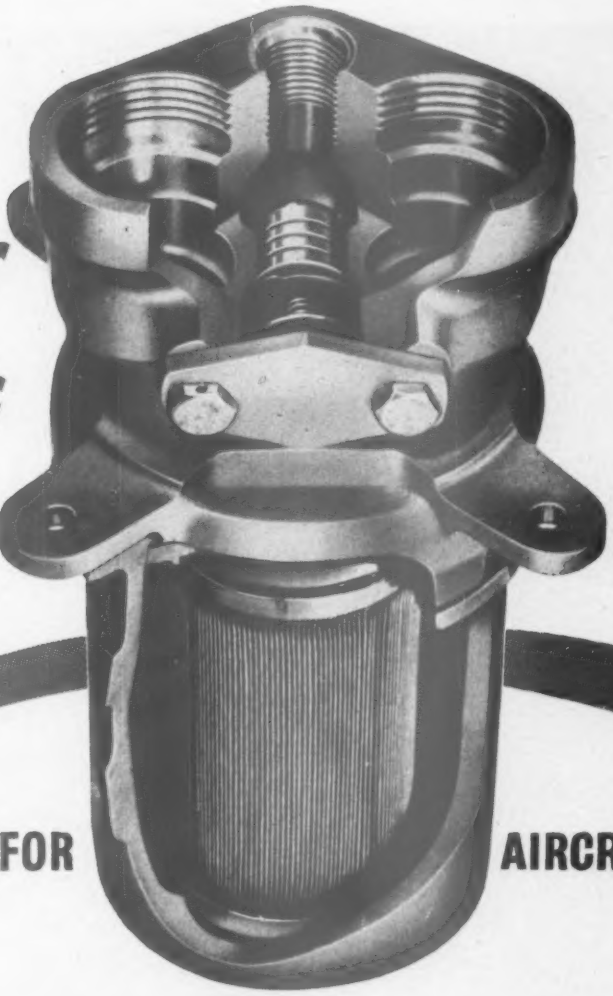
ROTAX

FULL COVERAGE BY ROTAX SERVICE IN MOST PARTS OF THE WORLD

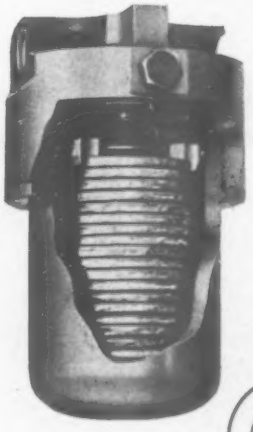
ROTAX LTD., Willesden Junction, London, N.W.10. (Elgar 7777)
LUCAS-ROTAX (AUSTRALIA) PTY. LTD., Melbourne and Sydney, Australia.
LUCAS-ROTAX LTD., Toronto, Montreal and Vancouver, Canada.

Second class postage paid at New York, N.Y.

Palmer Parmatic Filters



SPECIALLY DESIGNED FOR AIRCRAFT



The technically advanced filter

. . . technically advanced because it enables you to choose the best filter medium for the job, including stainless steel mesh with its high-permeability advantages for appropriate applications. This unfettered choice of media is backed by high performance/weight-and-volume ratio, minimum pressure drop, easy maintenance, and all the other aircraft filtration requirements that creative engineering has put into Palmer Parmatic Filters. Palmer Parmatic is more than a technically advanced filter, it is a filtration service.

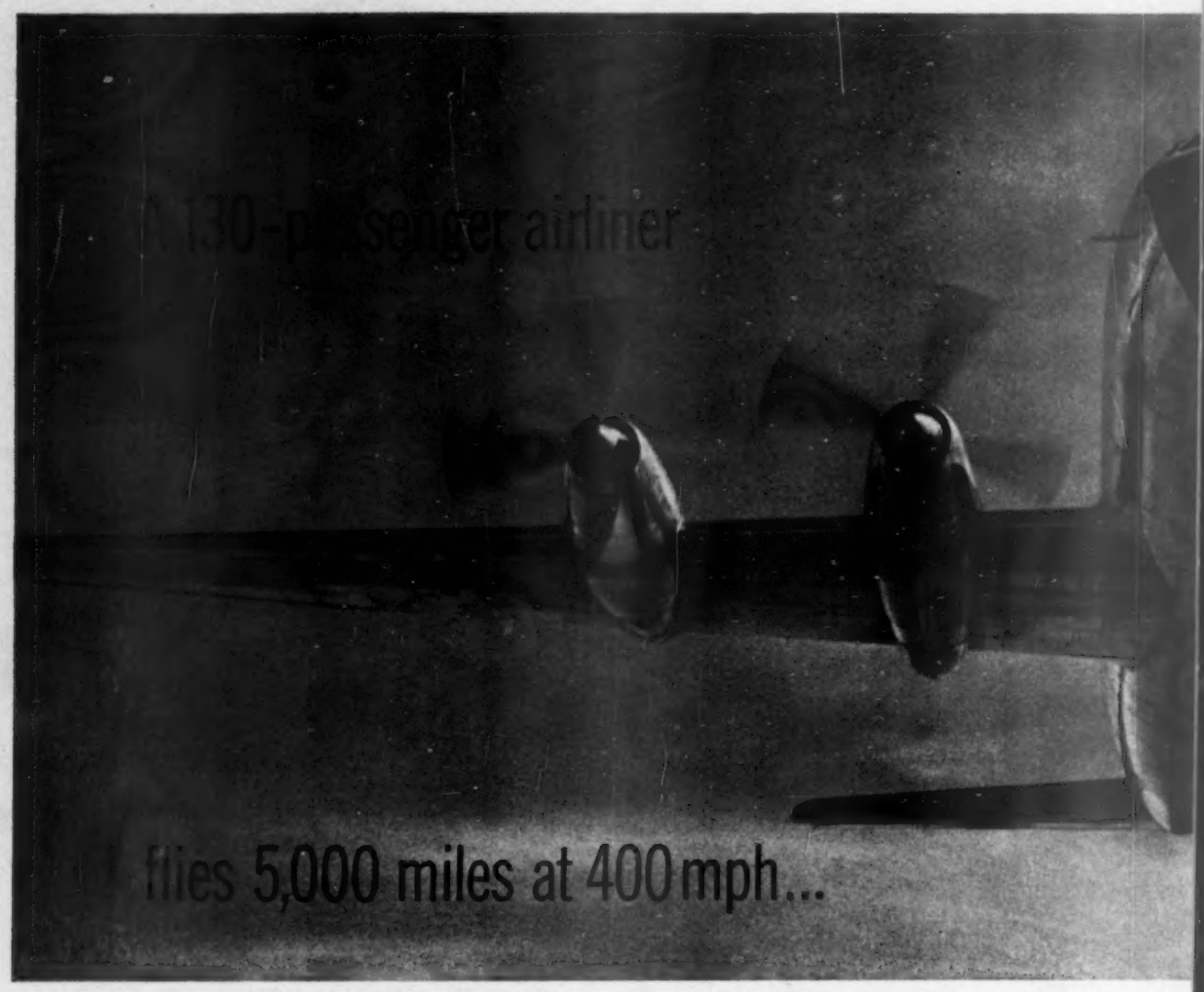
Palmer *leads again*

Palmer Aero Products Ltd PENFOLD ST. LONDON N.W.8

AERO PRODUCTS DIVISION · BTR INDUSTRIES LIMITED

6/2760

A

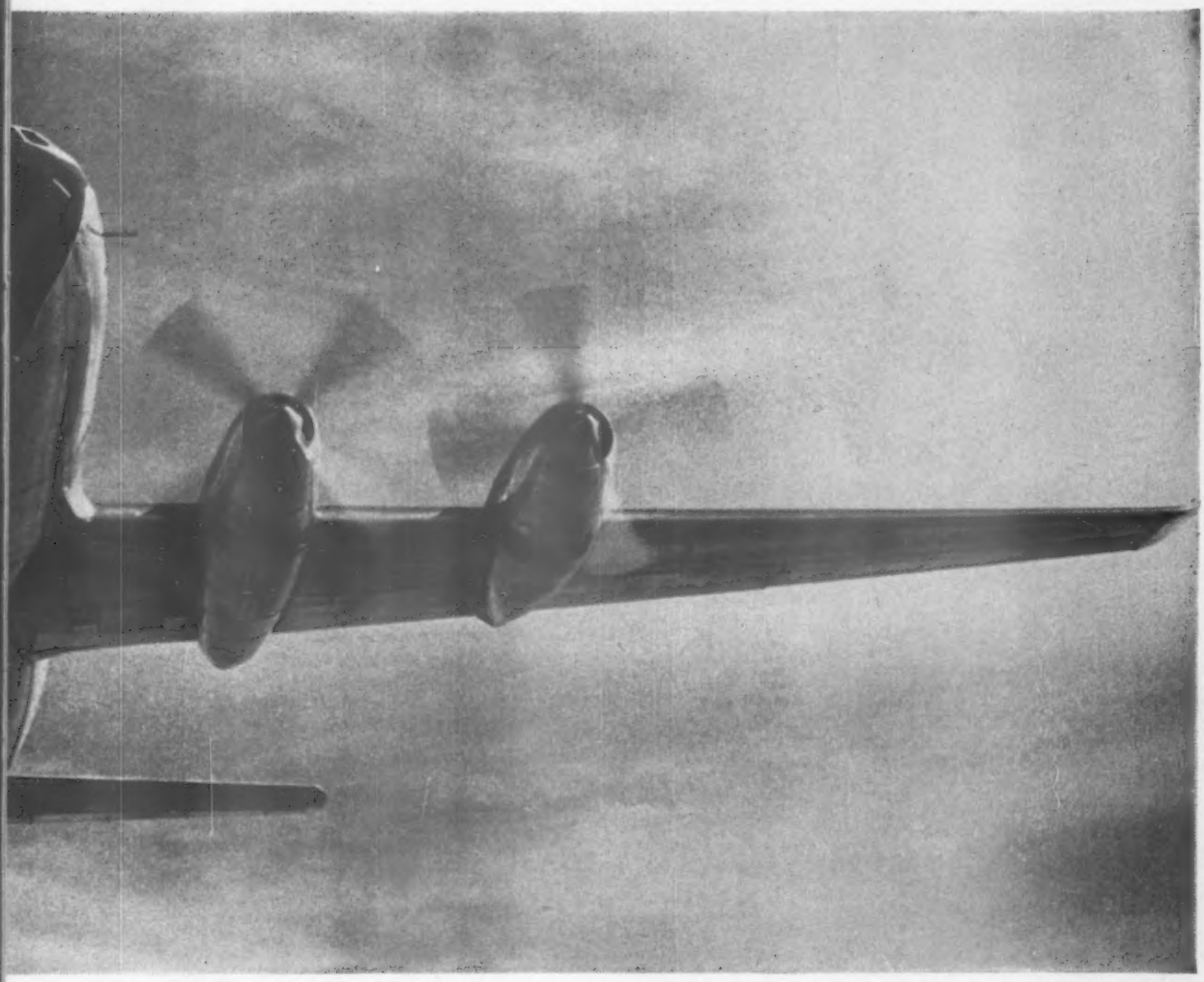


...AND BRISTOL SIDDELEY

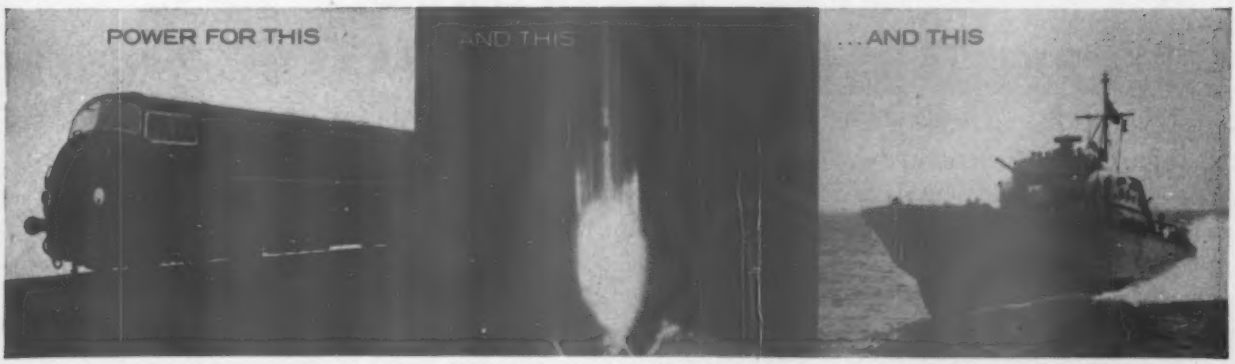
One of the largest manufacturers of motive power units in the world, Bristol Siddeley Engines Limited produce the Proteus.

A turboprop in the 4,000-hp class, the Proteus powers the Britannia airliner, in service with RAF Transport Command and ten airlines all over the world. The Proteus is perhaps the most dependable engine in the air today. It reached an overhaul period of 2,000 hours in under two years—a rate of increase never before achieved by any other engine, piston or gas turbine. Proteus derivatives have been designed for use as turbo-generator power plants and as marine turbines.

BRISTOL SIDDELEY ENGINES LIMITED



SUPPLY THE POWER



TWO BRISTOL SIDDELEY MAYBACH diesels power this British Railways diesel hydraulic locomotive—develop a total of 2,200 hp. A large number of Maybach diesel engines have been ordered by British Railways alone.

THE BRISTOL SIDDELEY GAMMA rocket engine powers the Saunders-Roe Black Knight—Britain's highly successful space research vehicle. The Gamma for a dry weight of only 700 lb—sends Black Knight 500 miles up into space.

THE BRISTOL SIDDELEY MARINE PROTEUS powers the world's fastest naval vessels, the "Brave" class Royal Navy patrol boats, built by Vosper Ltd. Three Proteus deliver a total of 10,500 hp —give these boats a speed of over 50 knots.

Features:
Press button, 9-position, back-rest, Bungee operated quick return with forward emergency fall. Non-fume removable ashtray housed in centre arm, also recessed fittings for detachable light-weight meal tray. Meal tray stowage and magazine pocket with zipped openings in rear upholstery. Individual retractable 2-position footrests fitted to each seat place. Life belt stowage at front on either side.

Rear view of seat, for B.E.A., showing meal tray extended and as recessed into rear of seat when not in use. Note overall clean lines.

Features:
Press button, 4-position, back-rest with controlled forward emergency break. Removable ashtray housed in centre arm. Meal tray elegantly fitted and recessed into rear of squab when not in use. Capacious plastic net pocket, readily accessible. Life jackets neatly stowed in front at either side.

COMET IV FIRST CLASS SEATS

NOW IN SERVICE WITH

AEROLINEAS ARGENTINAS & BRITISH EUROPEAN AIRWAYS

These seats, of Magnesium alloy, argon-arc welded tubular construction, have been developed to de Havilland specification and can be upholstered, with Lancedown interiors, to suit any requirement. Those for Aerolineas are particularly pleasing, upholstered in Stellar Blue and Mushroom Lurex cloth with armrests in matching Skye Blue leather. Overall weight: forward version only with footrests, 63 lb. Those for B.E.A. feature Clerical Grey cloth with contrasting Coral Synthede on the side panels and armrests in matching leather. Overall weight: forward version, approx. 62 lb., aft version approx. 67 lb.

LANCEFIELD AIRCRAFT COMPONENTS LTD

71-83 HERRIES ST., LONDON, W.10 · Telephone LADBROKE 2951 (4 lines)

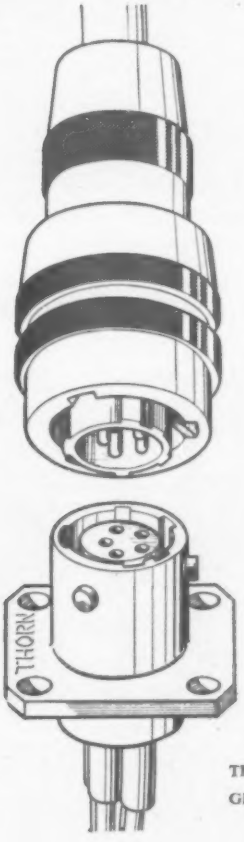
Thorn ELECTRICAL CONNECTORS

THORN AN SERIES

The Thorn AN series of electrical connectors includes solid shell/general purpose, pressurised and environmental resisting ranges. By specifying Thorn, designers are assured of a *genuine* AN connector for their installations . . . a connector designed strictly to the current MIL specifications.

Note these outstanding design and operating features.

- *Die-cast aluminium alloy shells cadmium plated for corrosion resistance.*
- *Resilient insert eliminates shrinkage problems and ensures superior electrical performance through high arc resistance, high dielectric strength and low moisture absorption.*
- *Thorn grommet increases flash-over and creepage distances, excludes dirt and moisture.*
- *Pressurised, water-tight, radio-quiet assembly.*
- *Maximum performance, minimum weight.*



THORN PYGMY PT SERIES

A new range of miniature connectors that satisfy the requirements of R.C.S. 321 (Category 40/100, class H.2 sealed items). Thorn Pygmy connectors are ideal for applications where space is limited and weight represents a critical factor of the installation.

- *Heavy gold plating over silver on all contacts.*
- *Performance unimpaired over a continuous temperature range from —40° to +100°C.*
- *Visual and audible inspection of coupling—perfect for "blind" locations.*
- *Three-point bayonet lock; perfect axial alignment of mating parts at all times.*
- *Five-key polarisation—positive protection against mis-mating or cross plugging.*
- *Miniaturised—light weight—compact.*

THORN ELECTRICAL INDUSTRIES LTD AIRCRAFT COMPONENTS AND CONNECTOR DIVISION
GREAT CAMBRIDGE ROAD ENFIELD MIDDLESEX TEL: ENFIELD 5353

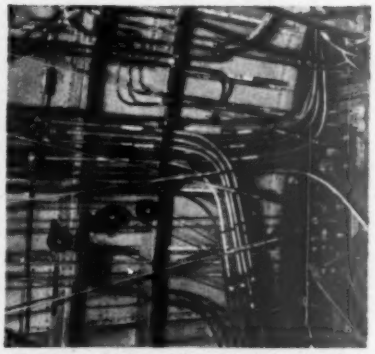
'FLUON' INCREASES PRODUCTION IN THE AIRCRAFT INDUSTRY

Twin Pioneer Aircraft built by Scottish Aviation Ltd., Prestwick.

'Fluon' conduits in Scottish Aviation Twin Pioneer

TELEFLEX Limited, Basildon, Essex, use 'Fluon' p.t.f.e. conduits in the Teleflex control system made for the Twin Pioneer because of its very low coefficients of static and dynamic friction which are numerically equal. In this way any tendency to stick-slip motion is avoided and the loading on the controls reduced by 60%. Since 'Fluon' is flexible the conduits can be formed to any desired shape.

In addition to its remarkable frictional properties 'Fluon' is immune to nearly all forms of chemical attack and will resist corrosion and degradation from ageing over an indefinite period. It can be used continually at temperatures up to + 250°C, while it retains its tough flexible nature down to at least liquid nitrogen temperatures.

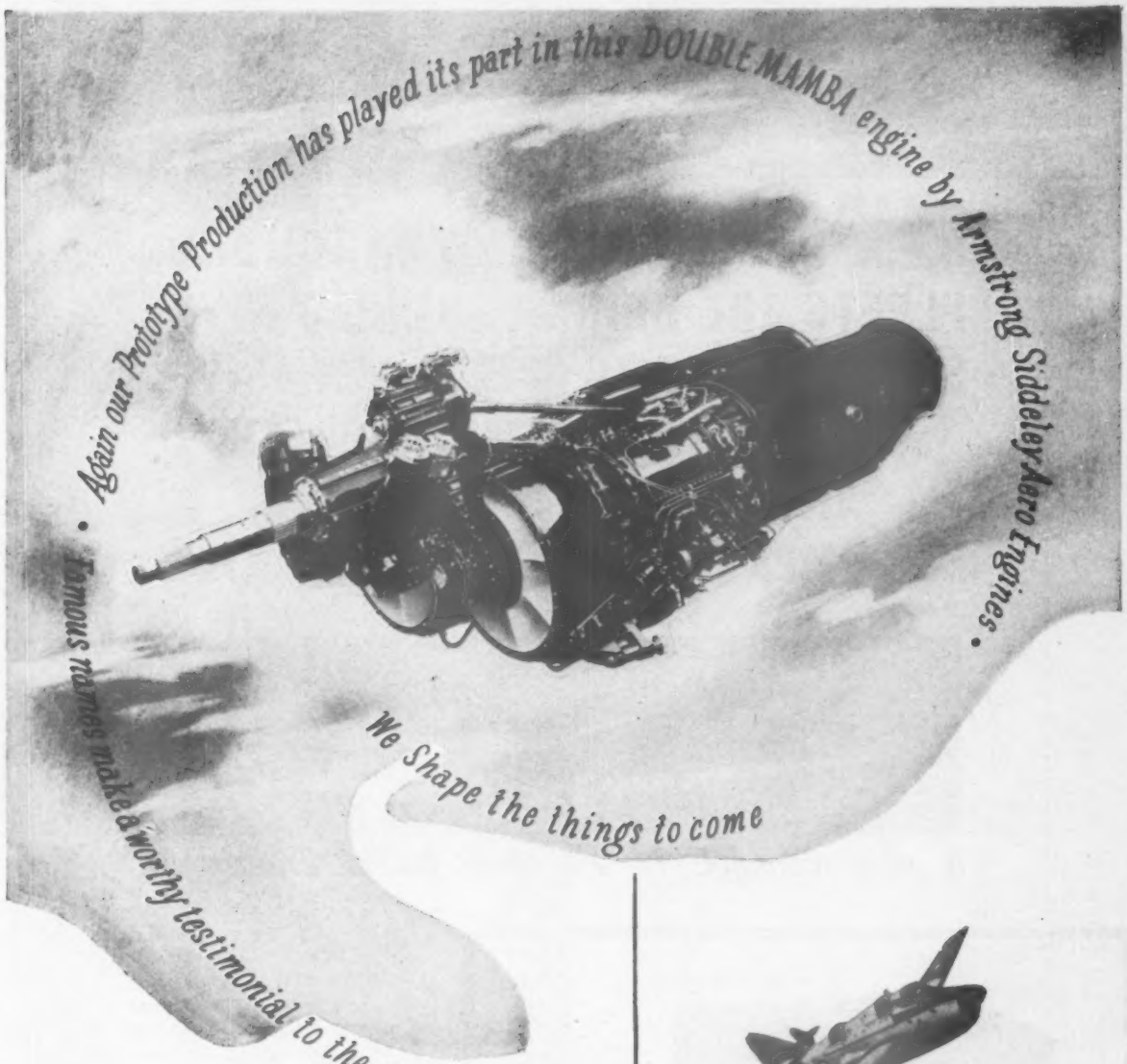


"Teleflex" 'Fluon' conduits made by Teleflex Ltd., Basildon, Essex, in Twin Pioneer engine control system.

'FLUON'

'Fluon' is the registered trade mark for the polytetrafluoroethylene manufactured by I.C.I.

ICI IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON S.W.1

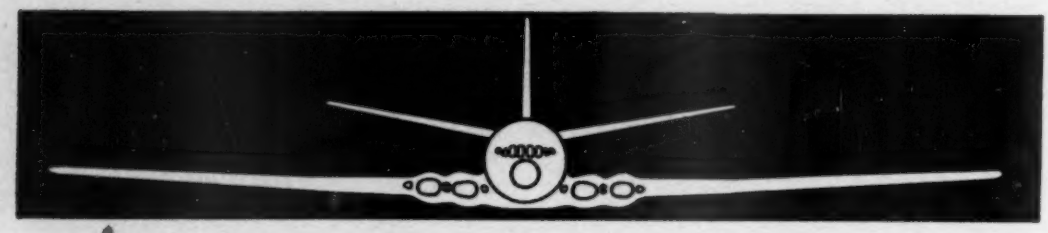

Again our Prototype Production has played its part in this DOUBLE MAMBA engine by Armstrong Siddeley Aero Engines
Famous names make a worthy testimonial to the quality of our work . . .
We Shape the things to come

Sir W. G. ARMSTRONG WHITWORTH AIRCRAFT LTD.
BRISTOL SIDDELEY ENGINES LTD.
BRISTOL AIRCRAFT LTD.
BRISTOL AIRCRAFT LTD. (Weston Works
HAWKER AIRCRAFT LTD.

THE ABBEY PANEL & SHEET METAL CO. LTD.

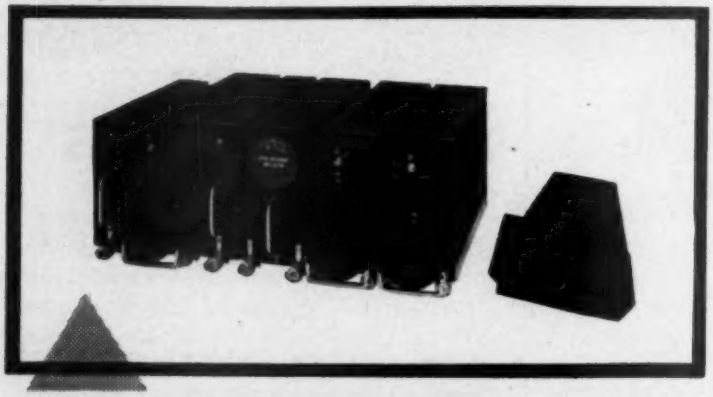
BAYTON ROAD · EXHALL · NR. COVENTRY · TEL: BEDWORTH 2071 PBX.

A.I.D. A.R.B. and C.I.A. Approved.



B.E.A. COMET IVB AND VANGUARD FLEETS ARE BEING EQUIPPED WITH STR 23/34/35/36 COMPREHENSIVE AIRBORNE VHF COMMUNICATION AND VOR/ILS NAVIGATION EQUIPMENT incorporating TRANSISTORS

A new concept in airborne Radio Equipment



Approx. half the weight, half the size, and half the power consumption of equipment it replaces!

ST.23 Transmitter. 360 channels, 50 kc/s channel spacing, in the band 118-135.95 Mc/s. 20 watts telephony.

SR.23 Receiver 560 channels, 50 kc/s channel spacing, in the band 108-135.95 Mc/s. All spurious responses at least 90 db down.

SR.34 V.O.R./I.L.S. Localiser Receiver. Comprises a Receiver and Instrument Drive Unit. The receiver is identical to and interchangeable with the SR.23. 100 channels, 100 kc/s channel spacing, in the band 108-117.9 Mc/s (50 kc/s spacing, incorporated and available when required).

SR.35 Glide Path Receiver. 20 channels in the band 329.3 to 335 Mc/s.

SR.36 75 Mc/s Marker Receiver. (Superheterodyne).

Operates from 115 volts. 400 c/s, single phase A.C. and 28 volts D.C.

STC SPECIAL SYSTEMS GROUP

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, London, W.C.2

RADIO DIVISION: OAKLEIGH ROAD · NEW SOUTHGATE · LONDON N.11

IT HAS TO BE FAULTLESS

Intensive practice, experience and precision are all necessary to give a faultless performance.

All of these qualities are combined in the production of Kidde equipment. Experience and precision ensure that only units capable of giving a faultless performance are released to the aircraft industry and practice in manufacturing has resulted in safe, simple and reliable products.

Designers and manufacturers of:—

Crew and passenger emergency oxygen systems.

Ultra lightweight portable oxygen equipment.

Inflation gear for dinghies.

Life jackets and escape chutes.

Pneumatic controllers.

THE WALTER KIDDE COMPANY LIMITED,
Belvue Road, Northolt, Middlesex
Tel. Viking 6611

Godfrey equipment

CABIN COMPRESSORS
COLD AIR UNITS
VALVES
SENSING UNITS
WATER EXTRACTORS
VAPOUR CYCLE COOLING EQUIPMENT
FANS
RADAR COOLING UNITS
TURBO ALTERNATORS
PNEUMATIC ACTUATORS
STATIC COOLING UNITS
TEST CABINETS
PRESSURE TESTING TROLLEYS
AIR CONDITIONING TROLLEYS

GODFREY

SIR GEORGE GODFREY & PARTNERS LIMITED

HANWORTH, MIDDLESEX AND HENLEY, OXFORDSHIRE Telephone: FELtham 3291 Cables: Godfrepart, London

ASSOCIATED COMPANIES IN MONTREAL, JOHANNESBURG AND MELBOURNE

The choice of the Experts...

A David Brown Aircraft Towing Tractor is used by The Fairey Aviation Co., Ltd. for ground handling of the Rotodyne, the world's first vertical take off airliner.

DAVID BROWN — EUROPE'S LARGEST MANUFACTURERS OF AIRCRAFT TOWING TRACTORS

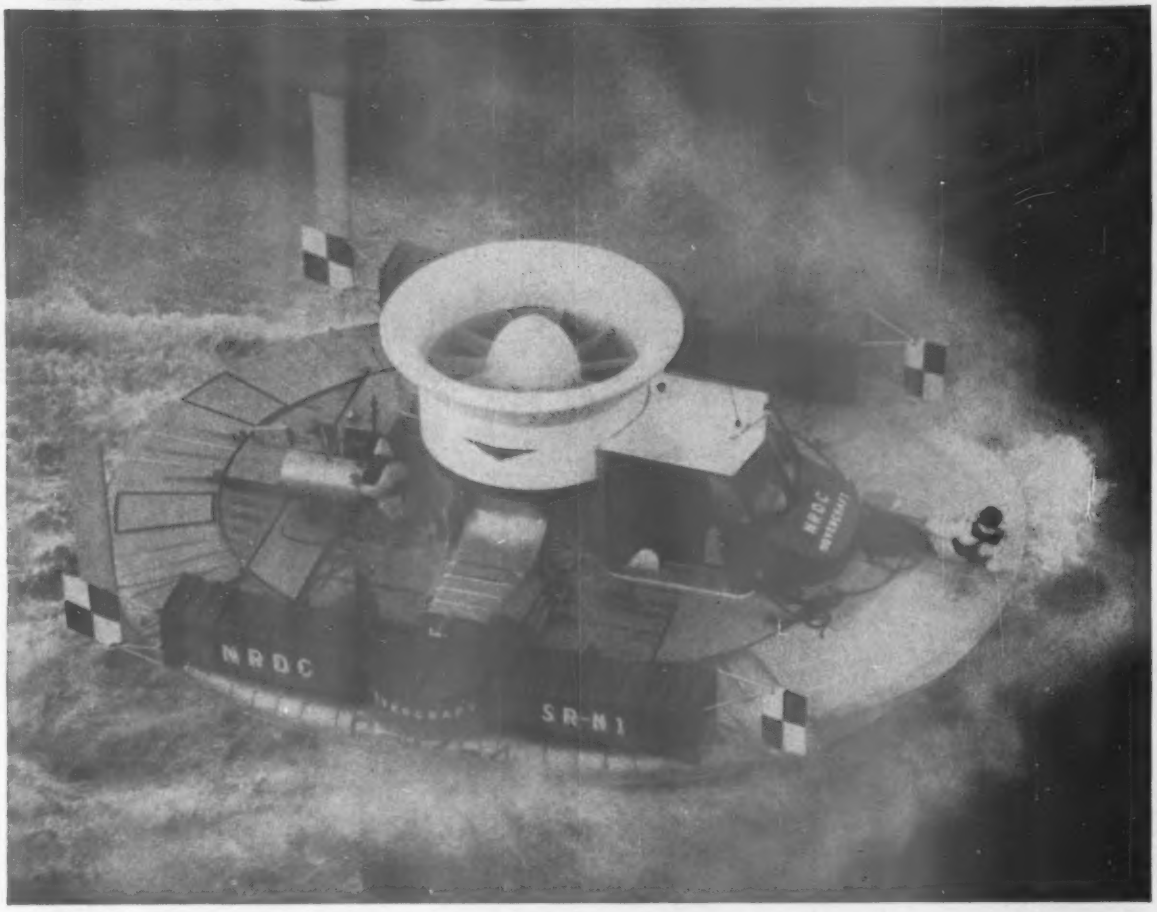
TASKMASTER · TURBO TASKMASTER (ALSO TWIN WHEELED VERSION)
TURBO TASKMASTER WITH AIRCRAFT STARTER AND SERVICING UNIT

DAVID BROWN CONSTRUCTION EQUIPMENT LTD.

A subsidiary of The David Brown Corporation Limited

MELTHAM · HUDDERSFIELD · YORKS. **TEL. MELTHAM 361**

Titanine



TAKE-OFF TO THE FUTURE

The Saunders-Roe Hovercraft takes air transport into a new era. We are proud that Titanine Aircraft Finishes are used for this revolutionary project. Keeping abreast of every new development in the air, Titanine serve the aircraft industry today, in meeting the challenge of the future.

TITANINE AIRCRAFT FINISHES

COLINDALE · LONDON · NW9

MOBILE ENERGISING

Houchin Mobile Energising Units range from 15 kW. to 300 kW.
They are robustly constructed, designed for maximum maintenance accessibility and noted for their reliability and constant performance under the most arduous conditions. Illustrated is a Houchin Dual Voltage Energiser D.C. Model servicing an Avro Vulcan.

Technical data and literature freely available on request.

HOUCHIN

Houchin Ltd., GARFORD WORKS, ASHFORD, KENT
(Ashford 1701-4) — Cables Garfodia, Ashford, Kent

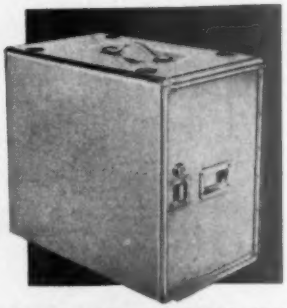
Manufacturers of Industrial and High Frequency Alternators. Complete Diesel Alternator Sets and Aircraft Electrical Starting and Servicing Units.

MALLITE

GALLEY EQUIPMENT

Meal Tray Boxes, Bar Boxes and Equipment Boxes

Lighter, Cleaner, Stronger and more rigid than Sheet Metal



TYPE I MEAL BOX

Designed to take 6 or 8 trays of 11" width and to fit a galley installation measuring 11¼" x 17-⅛" x 18½". Constructed from MALLITE EGB.4. which has given many years of service as an aircraft floor taking direct seat loads.

William Mallinson and Sons Ltd.

130 HACKNEY ROAD · LONDON · E.2

Telephone Shoreditch 7654 *Telegrams 'Almoner' London*

MANUFACTURERS OF PLYWOOD · ARMOURPLY · PANELS AND AIRCRAFT LAMINATES

Stream-Line Filters for trouble-free fuel

The use of Stream-Line Filters in the refuelling of aircraft ensures the removal of water and solid impurities from the fuel enabling complete fulfilment of official specifications.

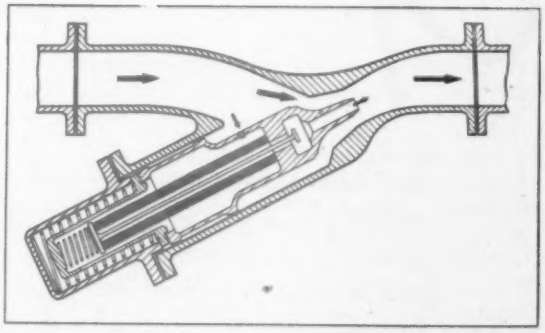
Top right is type K, a highly efficient filter consisting of a number of specially prepared paper discs compressed by springs and mounted on metal rods.

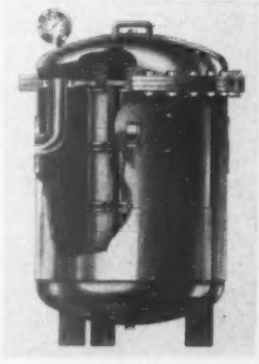
Fuel passes through the minute interstices between the discs leaving solid impurities at the edges. Any water present causes the paper to swell, with a consequent increase of back pressure, which gives an indication that servicing is needed.

Middle right is the Fuel Monitor designed in conjunction with the Shell Petroleum Company Ltd. This is a fully "fail-safe" device consisting of a valve and a water sensitive element continuously sampling the flow of fuel and causing the main valve to close if water contaminated fuel is revealed.

Bottom right is the high-output MC filter, giving what is for many purposes an acceptable filtration efficiency at a much higher rate than the K type.

NEW THREE STAGE FILTER. Stream-Line Filters Ltd., have recently developed a three-stage filter/water separator which uses pleated elements made from paper, fibreglass and nylon to remove from aviation fuels all solid impurities and all water in whatever proportions they may arise.





STREAM-LINE FILTERS for aircraft refuelling

STREAM-LINE FILTERS LTD., HENLEY PARK, NORMANDY, NR. GUILDFORD, SURREY.

Telephones : Normandy 3311-3 Telegrams : Edgefilt, Guildford.

A member of the VOKES Group with world-wide representation.

SF 102

MOBILE ENERGISING

Houchin Mobile Energising Units range from 15 kW. to 300 kW.
They are robustly constructed, designed for maximum maintenance accessibility and noted for their reliability and constant performance under the most arduous conditions. Illustrated is a Houchin Dual Voltage Energiser D.C. Model servicing an Avro Vulcan.

Technical data and literature freely available on request.

HOUCHIN

Houchin Ltd., GARFORD WORKS, ASHFORD, KENT
(Ashford 1701-4) — Cables Garfodia, Ashford, Kent

Manufacturers of Industrial and High Frequency Alternators. Complete Diesel Alternator Sets and Aircraft Electrical Starting and Servicing Units.

MALLITE

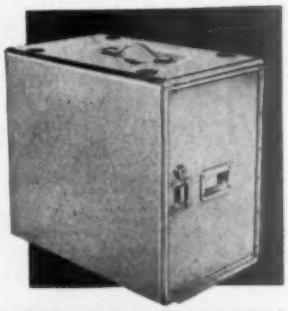
GALLEY EQUIPMENT

Meal Tray Boxes, Bar Boxes and Equipment Boxes

Lighter, Cleaner, Stronger and more rigid than Sheet Metal

TYPE I MEAL BOX

Designed to take 6 or 8 trays of 11" width and to fit a galley installation measuring 11¼" x 17⅞" x 18½".
Constructed from MALLITE EGB.4. which has given many years of service as an aircraft floor taking direct seat loads.



William Mallinson and Sons Ltd.

130 HACKNEY ROAD · LONDON · E.2

Telephone Shoreditch 7654 Telegrams 'Almoner' London

MANUFACTURERS OF PLYWOOD · ARMOURPLY · PANELS AND AIRCRAFT LAMINATES

Stream-Line Filters for trouble-free fuel

The use of Stream-Line Filters in the refuelling of aircraft ensures the removal of water and solid impurities from the fuel enabling complete fulfilment of official specifications.

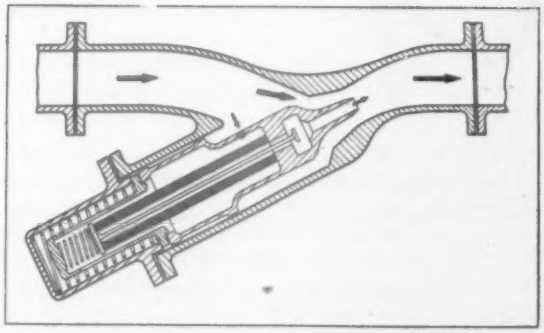
Top right is type K, a highly efficient filter consisting of a number of specially prepared paper discs compressed by springs and mounted on metal rods.

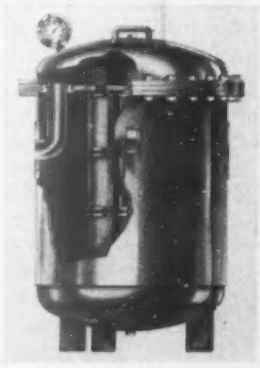
Fuel passes through the minute interstices between the discs leaving solid impurities at the edges. Any water present causes the paper to swell, with a consequent increase of back pressure, which gives an indication that servicing is needed.

Middle right is the Fuel Monitor designed in conjunction with the Shell Petroleum Company Ltd. This is a fully "fail-safe" device consisting of a valve and a water sensitive element continuously sampling the flow of fuel and causing the main valve to close if water contaminated fuel is revealed.

Bottom right is the high-output MC filter, giving what is for many purposes an acceptable filtration efficiency at a much higher rate than the K type.

NEW THREE STAGE FILTER. Stream-Line Filters Ltd., have recently developed a three-stage filter/water separator which uses pleated elements made from paper, fibreglass and nylon to remove from aviation fuels all solid impurities and all water in whatever proportions they may arise.





STREAM-LINE FILTERS for aircraft refuelling

STREAM-LINE FILTERS LTD., HENLEY PARK, NORMANDY, NR. GUILDFORD, SURREY.

Telephones : Normandy 3311-3 Telegrams : Edgefilt, Guildford.

A member of the VOKES Group with world-wide representation.

SF 102

From far beyond ship's horizon...

Gannet A.E.W. Mk. 3

BRINGS ALL-WEATHER WARNING

Ship's Radar can spot the low level raider at perhaps nine or ten miles; equivalent at today's airspeeds to thirty seconds flying time. Time to issue orders and train guns, with little to spare—no time to meet the attack half way. Now the Fairey Gannet A.E.W. Mk. 3 alters the naval picture. Nine or ten miles becomes 200, those few seconds become a period of vital minutes for flying-off and vectoring defending aircraft to meet the assault. The picture on the Gannet's screen is repeated by radar link in the ship, and through this link the aircraft can act as an airborne intelligence centre to direct defenders or strike aircraft. Surface and submarine vessels as well as aircraft are under its surveillance. The A.E.W. Mk. 3 Gannet multiplies the range of naval tactical intelligence at a time when the balance between air and sea power is biased against the ship.

(The Gannet is powered by a Bristol Siddeley Double Mamba engine)

FAIREY

FAIREY AVIATION LIMITED • HAYES • MIDDLESEX • *England* • *Australia* • *Canada*

THE AEROPLANE and ASTRONAUTICS

VOLUME 97 NUMBER 2504 OCTOBER 16, 1959

Aviation—The Future

Commentators have been busy cabinet-making. Some indication of Mr. Macmillan's intentions had been outlined in the Conservative manifesto. One idea circulated sufficiently rapidly, once the election results became known, for it to have all the appearance of inspiration. According to this story M.T.C.A. is to go, the M.o.S. is to go and their aeronautical functions are to be shared out between the new Minister of Science, promised in the manifesto, and a new Minister of Aviation, whose appointment at the time of writing is still speculative.

Few will be the tears shed over the demises, if confirmed, of M.T.C.A. and the M.o.S. Both are too unwieldy and both, in consequence, are held to be responsible for inertia and delay.

On the face of it, the appointment of a Minister of Aviation sounds splendid. It is only when one begins to speculate about the functions of his department and its organization that the snags appear. How will the new department stand in relation to the Air Ministry, the Admiralty and the War Office? And what part will the co-ordinators in the Ministry of Defence play? And if this sounds somewhat complex, speculate about the powers of the promised Minister of Scientific Affairs, who is, some say, going to be responsible for aeronautical research.

For good measure we must bring in the question of staffing; government departments have to be staffed by regular civil servants. Most of those with aeronautical engineering experience are in the Ministry of Supply. Do they go back to the Air Ministry or do they go to the new Ministry of Aviation?

A Minister of Science could do a splendid job if his function were to ensure that the Nation ploughs back annually the proper proportion of its gross annual income into research and development. It should then be for the Minister of Aviation and Astronautics, not he of Defence or of those of the Service Ministries, to allocate approved research funds for specific purposes. Long term research is vital for the continued life of the Aircraft Industry. The aims of such research should be determined by a specially constituted body, such as the Finletter Committee set up in the United States in 1947, which so many of us hope the Prime Minister will set up now.

Which of the new ministers is going to concern himself with the swiftest growing province of British aviation, that of business flying? Except in the limited field of agricultural aviation, crop spraying and the like, the British aircraft constructing industry is hardly yet interested in this business. For this reason it is hard to see why the Government should impose a swingeing import duty, 17½%, on foreign-built aeroplanes. This is simply making it even more expensive for British business men to take advantage of personal air transport. Surely, correct policy would be to foster a thriving business aeronautical community which, in due course, would provide a new market for the British manufacturer and thus enable him to reach out into a new export field.

And who is to lead British engineering along the arduous path to the stars, the Minister for Aviation or the Minister for Science? It is instructive to recall how much of the pressure for astronautical endeavour has come from the young engineers of the aircraft industry.

C

Editor - - - - THURSTAN JAMES
Deputy Editor - - F. T. MEACOCK

Founder Editor (1911-1939) *C. G. Grey*

Proprietors: TEMPLE PRESS LIMITED
Chairman and Managing Director:
ROLAND E. DANGERFIELD

Editorial, Advertisement and Publishing Offices:
BOWLING GREEN LANE, LONDON, E.C.1.

Telephone: TERminus 3636
Telegrams: "Pressimus London Telex"
Telex: 23839

Annual Subscription Rate: United Kingdom £4 15 0
Overseas £5. Canada and U.S.A. $15.00

© Temple Press Limited, 1959. The proprietors will consider any written requests to reproduce articles and illustrations appearing in this journal. Comment and brief extracts which acknowledge *The Aeroplane and Astronautics* are permissible.

Matters of Moment

Aviation and the New Government

AVIATION policy is to receive special attention by the new Conservative Government, which has been returned with an increased majority, and a clear mandate for up to five years in office. Cabinet changes are expected and may well have been announced before these words are read. One new appointment is to be made—a Minister for Science—and speculation suggests a re-alignment of ministries connected with aviation.

One suggestion is that the Ministry of Supply will be abolished and an Aviation Ministry set up; this would also take over certain of the air transport responsibilities of the Ministry of Transport and Civil Aviation as well as the M.o.S. rôle in aviation. According to this report, aviation research would come under the new Science Minister.

This suggestion is speculative, but some concrete facts were given in the Conservative election manifesto. To quote this, "Many individual industries have to adjust themselves to new conditions. The Government will play its part in assisting the aircraft industry to increase its sales and will help in fostering research and development."

How this will be done is not clear. But any way in which the Government can boost overseas sales of the British transports, military aircraft and missiles now under development will be welcome. The industry has not been as successful in selling its latest military products abroad as it was with those of the immediate post-war and Hawker Hunter generations. Missiles have been a particular disappointment and both with these and the latest fighters the U.S. has been a powerful and highly successful competitor.

So far as research and development is concerned a rapid decision is needed about a British supersonic airliner. Whether a decision is made for or against such an aircraft, the outcome must radically affect the future structure of the industry.

In discussing nationalized industries the Conservative manifesto stated: "We shall review the situation in civil aviation and set up a licensing authority to bring a greater measure of freedom to nationally and privately owned airlines." Such an authority will licence both operators and the routes over which they fly. The Minister responsible for civil aviation and the new authority will soon be called on to make some difficult decisions, particularly about the extent to which independent operators can run cut-fare services in competition with the airline Corporations.

Another election pledge says that a Minister for Science will be appointed to promote scientific and technological development. Among his responsibilities will be the D.S.I.R. (which controls the National Physical Laboratory), the atomic energy programme and the U.K. contribution to space research. Even if responsibilities are clearly defined such an appointment may well confuse rather than simplify Britain's aeronautical and space research programmes. At present these come mainly under the Ministry of Supply.

Sir Solly Zuckerman, who becomes scientific adviser to the Minister of Defence.

Space research is a particular problem. According to the Prime Minister it is now under the general supervision of "the Lord President of the Council, in consultation with the Minister of Supply and other Ministers concerned." The new Science Minister can at best act only as an "overlord," because any space boosters must be based on military vehicles developed for the M.o.S. In fact, the possibility of a confused and ineffective space programme controlled by an additional minister seems to be even greater than it is now, particularly as the overall cost will be only about £200,000 a year. In the U.S. the annual budget of NASA now approaches £180 million.

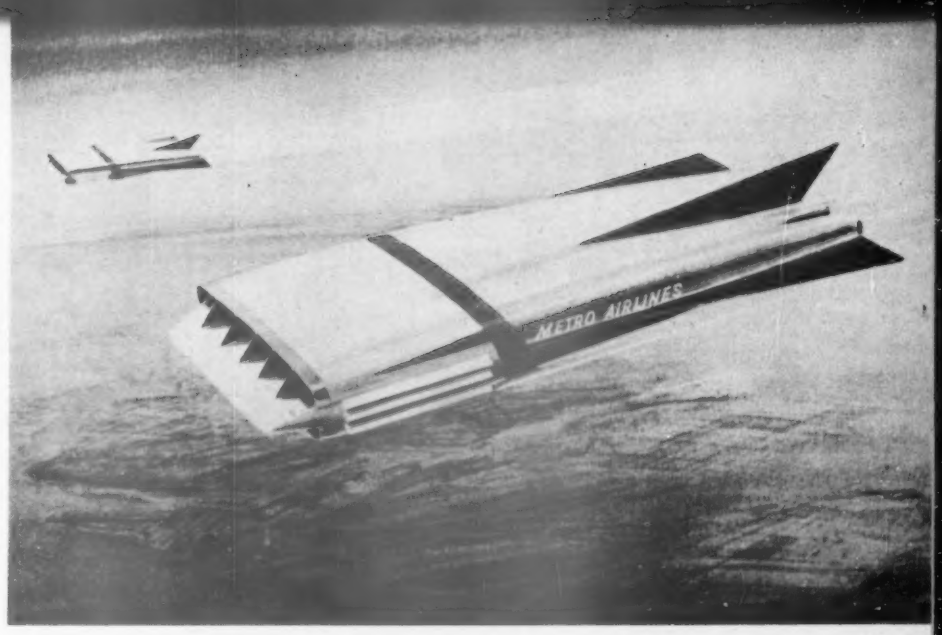
A New Ministerial Adviser

FROM the Ministry of Defence last week came news of the appointment of Sir Solly Zuckerman, C.B., F.R.S., M.A., M.D., D.Sc., M.R.C.S., L.R.C.P., as scientific adviser to the Minister of Defence, and chairman of the Defence Research Policy Committee. He succeeds Sir Frederick Brundrett who is to retire from public service at the end of the year. Sir Solly's appointment has been said to be a full-time one for a period of five years.

Although a zoologist by profession, he is no newcomer to the defence scene. His association with such matters started in 1939 when he was appointed scientific adviser to the Ministry of Home Security. Two years later he became scientific adviser to Combined Operations Headquarters and subsequently moved to the Mediterranean area to be scientific adviser on planning

GENERAL-PURPOSE TRANSPORT.—The Armstrong Whitworth AW.650 Argosy is now engaged in a series of European and World demonstration tours. It is powered by Rolls-Royce Dart turboprops.

Photograph copyright "The Aeroplane and Astronautics"



SUPERSONIC VTOL.—A wingless transport of the foreseeable future. Mr. Hibbard, in the course of the Dr. Albert Plesman Memorial Lecture at Delft, discussed this ram-jet powered flattened all-body configuration, flying at M=7.

to the Mediterranean Air Forces. In this capacity he was responsible for the detailed planning of air operations leading to the capture of Pantelleria and for planning attacks on the communications of Sicily and Southern Italy.

In 1943, Sir Solly became scientific adviser on planning (air) to the Allied Expeditionary Air Forces and to the Supreme Command in North-west Europe. He was, in fact, principally concerned with the conception and the design of attacks on communications in Occupied France, the Low Countries and Germany. At the end of the War he was appointed director of the British Bombing Survey Unit which analysed in detail the effects of the strategic bombardment of Germany. Since the War he has been concerned with defence problems as a member of the Advisory Council of the Ministry of Supply.

He was given honorary rank as Group Captain in the R.A.F. in 1943; received the U.S. Medal of Freedom with Silver Palm; and was made a Chevalier of the Legion of Honour in France.

Born in 1904 in Cape Town, Sir Solly was educated at South African College School, the University of Cape Town, and University College Hospital, London. He has held a number of important anatomical appointments and is Sands Cox Professor of Anatomy at Birmingham University. This professorship he is to retain and he will be available to the University for consultation.

MEDAL AWARD.—Sir Arnold Hall, managing director of Bristol-Siddeley Engines, Ltd. (right) receives the A.G. von Baumhauer Medal from Mr. C. Kolff, president of the Royal Netherlands Aero Club. Sir Arnold has been given the medal in recognition of his work in aeronautical science and his contribution to knowledge on fatigue.

B.E.A. Rotary Wing Plans

SCHEDULED helicopter services may be operated by B.E.A. within the next two years "if the difficult question of financing the operation can be resolved." The news that B.E.A. is proposing to purchase an interim helicopter, before deliveries of the Fairey Rotodyne begin in 1964, is given by Lord Douglas in the current edition of the *B.E.A. Magazine*. He says, "We would probably require a couple of 20- to 25-passenger multi-engined helicopters, in the class of the American Vertol 107 and Sikorsky S-61, or the British Bristol 192C."

Britain's Second Saucer

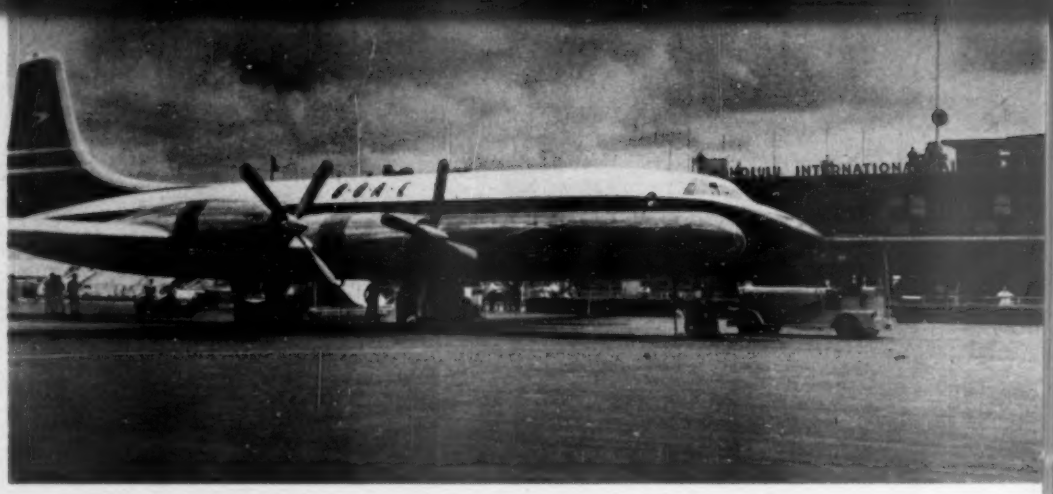
IN their many overseas operations in "inaccessible" areas, Crop Culture (Aerial), Ltd., have become well aware of the shortcomings of surface transport, and their interest in this subject has resulted in the development of a hovercraft-type vehicle. Designed by John Britten and Desmond Norman, the new research project is also being built on the Isle of Wight, at Bembridge, and its completion is expected before the end of the year.

Its general principles conform to the proven theory of air-curtain craft, but its "cushion" is generated by a different method from that of the Saunders-Roe SR-N1. It is hoped that the air pressure may be slightly higher than that in the Hovercraft, with a corresponding increase of the 12-in. hover height. The Britten-Norman vehicle will be similarly designed for operating over land or water, and will have a buoyancy hull of marine plywood.

Metal construction will also be used, and power will be supplied by an automotive-type engine. The craft will therefore be rather smaller than the SR-N1, with an all-up weight of about a ton. Airscrews rather than air ducts will be used for propulsion and control, and will be permanently engaged with the engine. A pair of propellers will operate in neutral pitch during hovering; they will operate differentially for directional control and will reverse pitch for braking.

Accommodation in the Britten-Norman research vehicle will be confined to a single bench-type seat, and it will probably differ somewhat in appearance from previous British and American types. It is being built as a private venture independently of the National Research Development Corporation, which is sponsoring the original Hovercraft. This was built at Cowes by Saunders-Roe, who recently issued a reminder to its employees not to discuss in public subjects involving commercial security.

MOON ROCKET.—Mr. J. E. Allen, of the Avro Weapons Research Division, demonstrates a projected five-stage vehicle for manned landings on the Moon. The project is described on page 365.



FAR-EASTERN AIR TRANSPORT. — A Britannia of B.O.A.C. at Honolulu where, recently, IATA's deliberations on the problems of fare reduction were concluded.

Aviation Insurance Discussed

EXPERIENCE with new types of turbojet and turboprop transports provided the main topic for discussion at the 18th annual meeting of the International Union of Aviation Insurers on October 7 and 8. This experience, from the underwriters' point of view, has not been a happy one and about $12 million has been paid out on total losses—which included a Boeing 707 and two Electras destroyed and a Comet damaged beyond repair.

Some 350 jet airliners are expected to be insured by October, 1960, and further losses are expected by the underwriters during 1960 and 1961, until adequate experience with the new types is gained. The introduction of these new types of aircraft has posed several problems, but information to date shows that the higher insurance rates have been justified. An important factor is the increasing cost of partial losses.

Other points made at the conference were the potential fire hazard from heat penetration from severe braking under emergency conditions, and from fuel being spilt on hot brakes during refuelling. A tribute was paid to the strength of the Comet fuselage as demonstrated in the Aerolineas Argentinas accident, and to the effective fire-prevention features.

Representatives of aviation insurance markets in 17 countries attended the meeting, and altogether some 550 individual companies were represented. British aviation insurance companies firmly support the Union, and Lloyd's Aviation Underwriters Association has recently applied for membership.

Sir Henry Tizard

IT is with regret that we record the death on October 9, at the age of 74, of Sir Henry Tizard, G.C.B., A.F.C., F.R.S., F.R.Ae.S., Hon.F.I.A.S., F.Inst.P. Widely known as a leading figure in aeronautical science and technology his close association with aviation began during the First World War when he joined the Central Flying School at Upavon. Later he became assistant controller of experiments and research in the R.A.F., and in 1920 was appointed assistant secretary to the Department of Scientific and Industrial Research. He became the Department's permanent secretary in 1927 and two years later was elected Rector of the Imperial College of Science and Technology—a post he held until 1942.

In 1933 he was appointed chairman of the Aeronautical Research Committee and became a member of the Council of M.A.P. in 1941 and an additional member of the Air Council in 1942. After the War, Sir Henry was invited to become chairman of the newly formed Defence Research Policy Committee, and the Advisory Council on Scientific Policy; he resigned from these posts in 1952.

Supersonic Airliners To Come

A DISTINGUISHED international gathering, guests of the Technological University of Delft, among whom were representatives of the British Aircraft Industry and U.K. Government Departments, listened to Mr. Hall Hibbard, senior vice-president of the Lockheed Aircraft Corporation, explain in that city last week how supersonic airliners, winged and wingless, could be regarded as technically feasible and economically sound for commercial operation. British visitors in particular noted that no questions of finance for development seemed to worry the lecturer. Mr. Hibbard, who was delivering the third annual Dr. Albert Plesman memorial lecture, persuasively demonstrated that supersonic airliners, built of steel and titanium, cruising around M=3 should have a direct operating cost, in cents per seat/mile, better than the figure for today's generation of subsonic jet transports. In the 1970s wingless VTOL craft powered by ramjets, cruising around M=7, could be expected to do even better.

Mr. Hibbard had been introduced by Dr. C. H. van der Leeuw, President of the University, who had first extended an especial welcome for Mrs. Albert Plesman. Dr. Leeuw allowed himself to speculate, for such is the rate of progress, whether the next memorial lecture might not be on the subject of interplanetary flight.

In our issue for August 28 we summarized at considerable length a paper which Mr. Hibbard (with Mr. Robert Bailey, Lockheed chief engineer) had given before the Institute of Aeronautical Sciences. Much of the same ground was covered at Delft, though Mr. Hibbard's approach was designed to emphasize in the Plesman memorial lecture the fact that there is today a great mass of international experience of supersonic flight. For instance, he told his audience that every day aircraft of the U.S.A.F. and U.S. Navy are putting up a total of 1,000 hours of supersonic flight. A British listener could not but wonder whether the R.A.F. could amass this figure in a year. It is perhaps proper to comment here that amassing figures of this sort with a few hundred military aeroplanes does not satisfy the airline engineer, he is interested in amassing flying experience with a single aeroplane to establish fatigue characteristics and the like. It is this aspect which, discussed at the current round-table meetings in this country, is giving the Air Registration Board much concern.

It was most interesting to note in the course of Mr. Hibbard's survey that neither of the two categories favoured in earlier discussions in this country, namely M=1.2 and M=1.8, came out well in the curves displayed. Indeed, so far as M=1.2 was concerned, it was noticeable that according to Mr. Hibbard's calculations, a machine in this category could carry no payload for the range envisaged. Indeed Mr. Hibbard categorically stated that it was improbable that supersonic aircraft will ever be designed to cruise between M=0.90 and M=1.5. His considered opinion is that a transport cruising at speeds between M=3.0 and M=3.5 will be the next step in commercial aviation. Such a machine could be operational in 1965 "if implemented." A laugh ran through the chrysanthemum-decorated hall when Mr. Hibbard remarked that a machine of this type in K.L.M. service would bring Amsterdam within 116 minutes of New York.

When one comes to higher speeds, the payload carrying capabilities of winged and wingless VTOL transports appear to be approximately the same. Further research is needed to decide the choice, but, said Mr. Hibbard, a wingless vehicle may be practical and efficient for cruise speeds at M=5 and higher. Such a vehicle, utilizing an efficient flattened all-body configuration in which the whole nose section is given over to inlets for the primary ramjet propulsion system, could provide transportation from Amsterdam to Los Angeles in an elapsed flight time of 98 minutes. The passengers would be carried in a cabin centrally placed and the ramjet ducts would be arranged to pass round it. Almost the concluding words of Mr. Hibbard were that the M=6 or 7 transport aeroplane might well have to be undertaken by industry without the advantage of military leadership.

Small wonder that Dr. H. J. van der Maas, chairman of the University's Aeronautical Department, in proposing the vote of thanks, expressed the view that fully to exploit the possibilities of supersonic flight would require international collaboration and that, he added, was even more true of astronautics and space travel.

The Fighting Services

New W.R.A.F. Director

GROUP OFFICER A. STEPHENS, M.B.E., is to become Director of the W.R.A.F. with the acting rank of Air Commandant, in succession to Air Cdt. Dame Henrietta Barnett, D.B.E., who is retiring from the Force. Gp. Off. Stephens, who will take up her new appointment in March, 1960, has been the W.R.A.F. Administration Officer at Headquarters, Technical Training Command, since July of this year, prior to which she served as W.R.A.F. Staff Officer at Headquarters, 2nd T.A.F.

Staff Course Century

TO mark the completion of the 100th Command and Staff course for junior officers at R.A.F. Bircham Newton, the Chief of the Air Staff, Marshal of the R.A.F. Sir Dermot Boyle, is to review the students today (October 16).

The course which was held at the R.A.F. School of Administration was until recently known as the Officers' Advanced Training Course ("The Oats"), but a more apt title has been introduced to clarify its function. On September 1 last the School of Administration and Administrative Apprentices Training School lost their identity and the tasks formerly done by them were assumed by R.A.F. Bircham Newton. The Officers' Advanced Training Course was originally known as the Junior Commanders' Course.

Having its origin in 1943, when the first students were sent to the Junior Commanders' School on a two-weeks' course at Dallachy, Morayshire, the course was later taken at R.A.F. Cranwell (1944) and then at R.A.F. Digby (1945). Similar courses were taken at Amman (Jordan) and Malta during and just after the War.

The post-war Officers' Advanced Training School was established at R.A.F. Hornchurch in 1947. There were then two different courses, one for senior and one for junior officers; the former was discontinued in 1950, although certain senior officers attended up to 1953. The School had moved to Bircham Newton in 1948, when it came within Technical Training Command. In April, 1951, the title and rôle of Bircham Newton were changed to the R.A.F. School of Administration.

The concept of the course has remained fundamentally unchanged over the years, although its syllabus has been adjusted periodically to suit changing conditions. For a number of years the course has lasted eight weeks and is now held five times a year. Since its inception in 1943, 8,002 students have completed the course, 7,285 of them junior officers.

Royal Visit

H.R.H. THE DUCHESS OF GLOUCESTER is to visit the Central Navigation and Control School, R.A.F. Shawbury, on October 22. After flying to the station, H.R.H. will inspect a guard of honour before lunching in the Officers' Mess.

During the afternoon Her Royal Highness is to visit the two instructional Wings at the station and the Navigation and Air Traffic Wings. The former provides advanced training for experienced navigators drawn from the operational Commands, and the latter trains all air traffic control officers on basic and advanced courses and provides trade training for N.C.O.s and airmen destined to become aerodrome controllers and operations clerks.

In the First World War, Shawbury was a flying training school. The Central Navigation School, which later became the Empire Air Navigation School, was established there in February, 1944, and in February, 1950, the station became the home of the Central Navigation and Control School.

Explaining the Policy

THE Chief of the Air Staff, Marshal of the R.A.F. Sir Dermot Boyle, is a firm believer in the importance of visiting units of the Service throughout the World and of meeting and talking to individual officers and men. He feels that this serves a valuable two-fold purpose. It allows him to keep in touch with the Service of which he is the professional head and it helps the members of the R.A.F. to understand more fully the reasons behind the policy directions which come from Whitehall and to appreciate the background of events against which decisions affecting the shape, size, equipment and deployment of the Service are made.

At the beginning of this year, the C.A.S. made a 20,000-mile tour of the Middle East and Far East Air Forces, talking to as many officers as possible. In April he paid a similar visit to the R.A.F. in Germany. And during the past weeks he has been on a tour of all R.A.F. Commands in the United Kingdom, where he has talked collectively to some 7,000 officers and met many of them individually.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. D. Price, M.A., Gp. Capt. H. F. Folley and Wg. Cdr. A. Marr to the Department of the Air Member for Supply and Organization; Wg. Cdr. S. F. Kettell, Wg. Cdr. D. C. Bunch, D.S.O., Wg. Cdr. T. P. McGarry, D.F.C., and Wg. Cdr. P. Dobson, D.S.O., D.F.C., A.F.C., to the Department of the Chief of the Air Staff.

Bomber Command: Wg. Cdr. C. D. A. Browne, D.F.C., to R.A.F. Bassingbourn as Chief Instructor and to command the Flying Wing.

Fighter Command: Gp. Capt. Crowley-Milling, D.S.O., D.F.C., to Headquarters in charge of Operations.

Transport Command: Gp. Capt. J. O. Barnard, O.B.E., to Headquarters in charge of operations; Wg. Cdr. E. Hearl, O.B.E., to R.A.F. Abingdon as Senior Technical Officer; Sqn. Ldr. W. E. F. Gray, A.F.C., to R.A.F. Lyneham to command No. 99 Squadron with the acting rank of Wg. Cdr.

Flying Training Command: Sqn. Ldr. G. F. Clark to R.A.F. Manby to command the Flying Wing, with the acting rank of Wg. Cdr.; Sqn. Ldr. B. Moorcroft, D.S.O., D.F.C., to R.A.F. Shawbury as Chief Navigation Instructor with the acting rank of Wg. Cdr.

Technical Training Command: Gp. Capt. C. H. Press to No. 2 Radio School, Yatesbury to command; Gp. Capt. C. S. Harley to Headquarters as Deputy Provost Marshal; Sqn. Ldr. J. P. Ford, A.F.C., to R.A.F. Halton, to command No. 3 Wing, retaining the acting rank of Wg. Cdr.

Other Appointments: Gp. Capt. P. C. Webb, D.F.C., to be Air Attaché, Ankara; Gp. Capt. D. B. Fitzpatrick, O.B.E., A.F.C., to command the R.A.F. Unit on Christmas Island; Wg. Cdr. A. C. L. Mackie, D.F.C., to the Directing Staff of the Joint Services Staff College; Wg. Cdr. E. B. Loftus and Sqn. Ldr. S. J. T. Goose, M.A., to the Ministry of Supply; Sq. Ldr. Goose to be granted the acting rank of Wg. Cdr.

Notes and Events

No. 207 Squadron.—A comprehensive history of No. 207 Sqn., is being compiled by Flt. Lt. A. I. Alder, who requires more personal detail and incident than is officially available. Past members who can help with anecdotes or photographs are asked to send them to the Squadron at R.A.F. Marham, King's Lynn, Norfolk.

Royal Appointment.—Sqn. Ldr. H. S. Carver has been appointed a temporary Equerry to H.M. the Queen. Until recently he was C.O. of the Day Combat Squadron at the Central Fighter Establishment, R.A.F. West Raynham.

F.E.A.F. Sharpshooter.—Flt. Lt. T. Powell, "A" Flight Commander of No. 77 Squadron, R.A.A.F., at Butterworth, won, by a wide margin, the recent F.E.A.F. gunnery competition held in Malaya. A graduate of the R.A.F. College, Cranwell, he joined the R.A.A.F. in 1957.

Reunion.—This year's annual dinner of the 1914-18, 7 and 14 R.N.A.S. and R.A.F. Handley Page Squadrons Association will be held at the Coronet Bar, Soho Street, London, W.1, on October 24. Details from Mr. G. Conley, 62 Nightingale Lane, London, S.W.12.

Marshal of the R.A.F. Sir Dermot Boyle addressing officers of Fighter Command assembled at R.A.F. Stanmore Park during his recent tour of U.K. Commands.

Air Transport

Stalemate in Hawaii

THE limited amount of information from Honolulu—where the IATA traffic conferences ended on October 10—suggests, as we go to press with this issue, that very little has been achieved so far as fare reductions are concerned. Such minor reductions as have been agreed were the result of bilateral arrangements.

An extension of economy fares to routes other than the North Atlantic was resisted and at least one pro-economy protagonist is believed to have resisted, in turn, the abolition of tourist class on the Atlantic. B.E.A.'s somewhat complicated plans for piecemeal reductions in Europe were, by and large, unacceptable. The position over the turbojet surcharge is not clear; this is not, at present, causing any traffic trouble to the turbojet operators, so it is probable that there were no serious battles on this point.

To the onlooker it seems that events might have moved—or have been made more likely to move in the future—in the direction of lower overall fares if the two British air corporations and the independent operators had gone to Hawaii with an agreed policy and had voted and vetoed, as the case may be, firmly together.

Introduction to Tokyo

THE main points made by Sir William Hildred, the Director General of IATA, in his statement at the opening of the 15th annual general meeting of the Association in Tokyo, concerned the financial state of the airlines; the need for reduced fares and rates; the importance of the cargo market; and the difficulties still being experienced because of the military use of blocks of high-altitude airspace.

He also examined the details of the traffic returns for 1958 and the various groups of figures which added up to overall results which were not particularly bad. As we explained in our issue of September 18 (p. 212) the total results were depressed by the poor figures for U.S. domestic operators—thus, as Sir William put it, "pulling the rug out from under the World-wide total."

According to ICAO figures, 1958 World airline operation lost something like $160 million, but Sir William thought that the results of international operations "were closer to breaking even." On a basis of profit/loss related to total expenditure, the estimated 1958 results were the worst since 1947; the best year was 1950 and the highest profit ($84 million) was made in 1956. A table on this page shows the figures for 1950-58.

Of fares, Sir William said that the airlines' problem was "to attain the highest possible economy of operations as the basis for the lowest possible price and then to squeeze the greatest amount of traffic out of whatever market that price level enables us to exploit." He had said earlier that within 12 months the turbojets will be offering more capacity than all the other aircraft in the IATA fleets and that "we shall have to feed progressively larger gobbets of traffic to these monsters, or they will eat us up, capital and all."

The airlines were not even now filling all the cargo capacity offered and available space would increase rapidly. By comparison with other forms of transport the capacity even then will be small, but the amount which will be sold "by present rating systems and sales appeals will be smaller still." This "presents airline managements with a greater challenge . . . than any in the passenger field." Bulk business must be tapped and to get this the shippers and (particularly) the consignees must be "aggressively" convinced of the good overall economics and advantages of properly organized air carriage.

Although the military authorities were now more understanding and helpful about air-space blocking, "the goodwill has been of slow growth and is being outpaced by developments."

Sir William echoed a majority view in his comments on the supersonic transport which seems to be "too much to be borne when we are struggling with Mach 1." He added that it may turn out to be a "quite amenable animal" if its development is treated as part of a total system and if the operators "make sure that navigation aids, terminal facilities and all the other concomitants develop harmoniously with it."

Of co-operative airline plans he said that projects such as Air Union "have all proceeded from the inexorable logic of economics. They will all improve the economic position of their participants. But they do not exhaust the possibilities; others would benefit from a searching look at their own situations."

Scheduled IATA traffic-increase percentages, 1950-1958

	1950	1951	1952	1953	1954	1955	1956	1957	1958
	%	%	%	%	%	%	%	%	%
Passengers carried ..	14.8	23.2	13.5	20.1	12.7	16.4	15.9	10.2	7.3
Miles flown	5.1	8.8	12.6	13.6	7.4	11.1	12.0	10.1	8.6
Cargo ton-miles ..	26.2	9.3	7.6	13.0	8.9	14.6	16.1	9.3	21.5
Mail ton-miles	11.4	19.3	9.5	9.6	17.5	13.9	10.1	4.9	10.3

Scheduled operating revenues and expenses, 1950-1958 (ICAO figures)*

	1950	1951	1952	1953	1954	1955	1956	1957	1958†
Revenues (U.S. $millions)	1,543	1,804	2,050	2,314	2,560	3,025	3,510	3,971	4,200
Expenses (U.S. $millions)	1,502	1,780	2,063	2,317	2,528	2,947	3,426	4,012	4,360
Profit or loss (U.S. $millions)	+41	+24	−13	− 3	+32	+78	+84	−41	−160
Profit or loss as % of expenses	+2.7	+1.3	−0.6	−0.1	+1.3	+2.6	+2.5	−1.0	−3.7

* Excluding the U.S.S.R. and China. † Estimated.

And Now Air Charter

FARE reductions ranging from £5 for a small car to £14 for a large one have been announced by Air Charter on the Channel Air Bridge. They will be effective from October 15, 1959, to May 31, 1960, on routes from Southend to Calais, Ostend and Rotterdam, and in some cases bring the rates for cars below those charged for the sea crossing.

During 1959, Channel Air Bridge has made 10,800 Channel crossings carrying 19,000 vehicles and 93,000 passengers. More than 20,000 "no-passport" day trippers have been carried—many more than expected.

Like Silver City (THE AEROPLANE AND ASTRONAUTICS, October 9, p. 306), Channel Air Bridge is awaiting Government approval of its planned "deep penetration" routes to Paris, Dusseldorf, Tours, Bremen, Dijon, Strasbourg and Lyons, which it hopes to introduce progressively, beginning late next year. Progress is being made with the first ATL 98 conversion of a DC-4 as a vehicle ferry. With a new front fuselage and nose loading doors, these aircraft will carry six cars and 25 passengers at 200 m.p.h. on the projected services and the existing cross-channel routes.

B.E.A.'s Good Summer

IN the six-month summer season, B.E.A. made a profit of more than £4½ million, after allowing for interest on capital. This figure was the result of record traffic, with a passenger load factor of 73% and an overall load factor of 70%. More than two million passengers were carried in the six months, and 80 million load ton-miles were sold. Traffic was up by about 20% over the level of 1958, but the Corporation was able to increase its capacity offered by only about 5%.

During the coming winter months, a large part of this profit will inevitably be taken up, but the Corporation has good reason to hope that a substantial profit will remain at the end of the financial year, on March 31, 1950.

Test-flight Accident Report

ON April 1, 1958, a Skyway's Hermes 4 (G-ALDV) crashed during a test flight from Stansted; last week the M.T.C.A. issued its accident report after a very detailed investigation. The crew of three were killed in the accident, but RT messages, 14 minutes after take-off, had made it clear that the elevator controls had partially or entirely jammed.

Examination showed that "a hard object such as a small split pin" had fouled the mechanism and score marks showed that considerable force had been applied in partially successful efforts to move the controls. The object was not found in or near the wreckage, but several small extraneous items were found in the stern frame bay of this and of another Hermes in the fleet.

The report observes that the difficulty of keeping aircraft free from extraneous objects is something of which constructors and operators have always been aware; "the structure of aircraft is such that small objects can find their way into crevices and inaccessible places. The importance of guarding against this happening and the necessity for absolute cleanliness cannot be emphasized too strongly."

The Airliner

with the Biggest Profit Potential

is the

Vickers VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

The following five pages

give you in detail

THE REASONS WHY

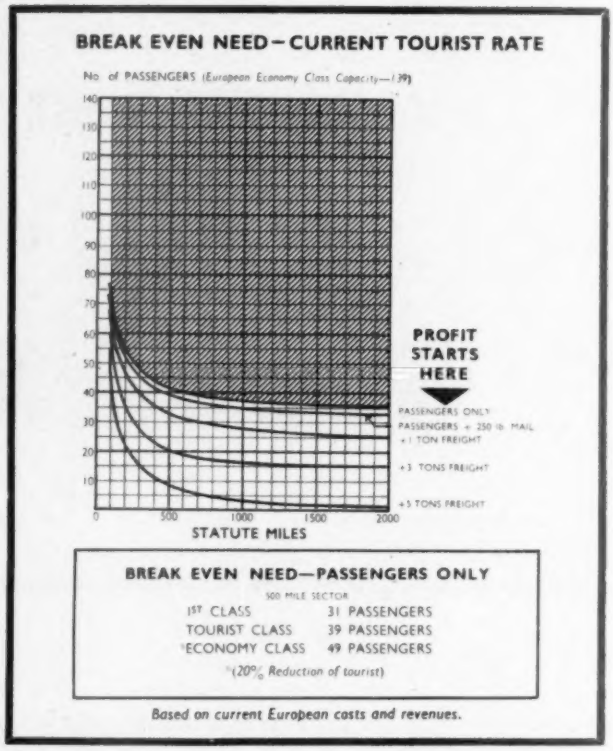
Only the VANGUARD

has this low-cost story

THE CONCLUSIONS to be drawn from this simple graph are among the most significant ever put to airline operators. It shows at a glance that the Vickers Vanguard will break even on total costs (indirect costs are taken as 100 per cent of direct) with passenger loads no higher than those actually carried by Viscounts today.

With three tons of freight the passenger break even requirement can be as low as 21 people falling to only 8 passengers when five tons of freight is carried for 500 miles. The Vanguard is a profitable aircraft on today's payloads yet it has room for the inevitable expansion of traffic which, even at a modest progress, makes the Vanguard the biggest potential money earner ever built.

In addition to its outstanding economy, the Vanguard is fully competitive in speed (425 m.p.h. cruise), and its turbo-prop flexibility will enable it to maintain schedules as good as any, while allowing for realistic traffic conditions.



Based on current European costs and revenues.

Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 7/8 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

• ***The airliner with the biggest profit potential ever offered to the operator***

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

TGA AT624

Only the VANGUARD
paces the jets at much less than half the cost

ALL ROUND Europe, and on record flights in Canada, the Vickers Vanguard has been logging block times which have proved that on short and middle distance routes it can more than hold its own with the jets. It has, in zero wind, beaten current jet schedules on sectors as long as London-Rome (955 st. miles). It has flown London-Gander (2,365 st. miles) in 5 hours 30 minutes, and Toronto-Montreal (335 st. miles) in a record 58 minutes in zero wind.

Other Vanguard block times are:

LONDON-BRUSSELS
230 miles in 45 minutes (5 m.p.h. headwind).

LONDON-HAMBURG
470 miles in 73 minutes—a record (17 m.p.h. tailwind).

LONDON-PARIS
224 miles in 41 minutes (zero wind).

PRESTWICK-KEFLAVIK
920 miles in 2 hours 35 minutes (zero wind).

KEFLAVIK-MONTREAL
2,360 miles in 6 hours 2 minutes (30 m.p.h. head-wind).

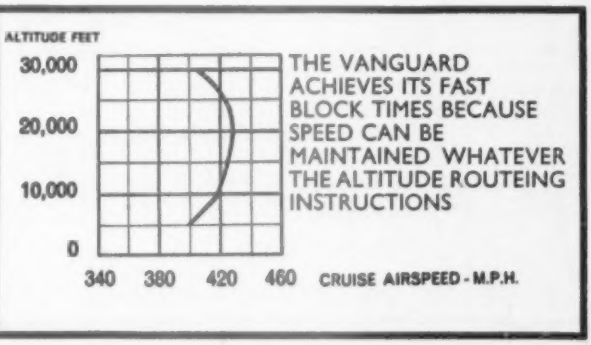
The Vanguard has achieved these block speeds at costs nearly one-third of those of comparable pure jet aircraft.

Recent U.S.A. figures show jet aircraft flight hour direct costs as 2.8 times greater than those of the Vanguard, and seat mile direct costs 2.6 times as great.

The Vickers Vanguard has, without doubt, the biggest profit potential ever offered to the airline industry — and it offers it at proved realistic competitive speeds.

The Economy Class cheap-fare capabilities of the Vanguard are at the forefront of the now established world movement for popular air travel. Only the Vickers Vanguard can bring these vast new markets to the Airlines on short and medium haul routes, at a substantial profit, and the Vanguard can do this with schedules as fast, if not faster, than any other aircraft.

Vanguard costs used in this comparison are to A.T.A. formula. Both the Viscount 745 and the Viscount 810 filed costs have been proved in practice to be substantially below such A.T.A. formula costs.



Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 7/8 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

VICKERS VANGUARD
FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

• ***The airliner with the biggest profit potential ever offered to the operator***

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

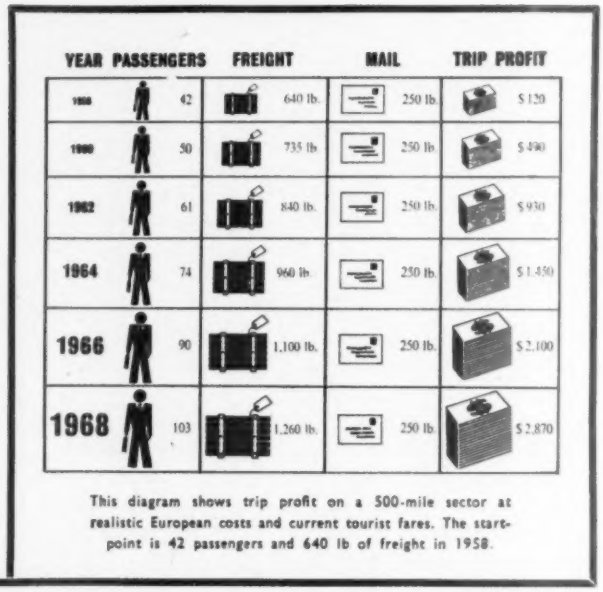
AT 457

Only the VANGUARD has this future while making money right from the start

THE VICKERS VANGUARD is designed for growing traffic, yet it will make profits right from its introduction with payloads no bigger than those carried by Viscounts today.

This is clearly shown in the illustration. Profit begins with the first 500-mile trip carrying no more than 42 passengers and 640 lb of freight. Even on modest estimates of traffic and freight increases, its profits will grow considerably with the years.

Assuming a 10% increase per annum in traffic, and 7% in freight, annual and cumulative profit at the end of seven years is remarkably high. By employing the Vanguard's cheap-fare possibilities, payloads and profits could be much higher.



This diagram shows trip profit on a 500-mile sector at realistic European costs and current tourist fares. The start-point is 42 passengers and 640 lb of freight in 1958.

Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 7/8 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

• ***The airliner with the biggest profit potential ever offered to the operator***

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

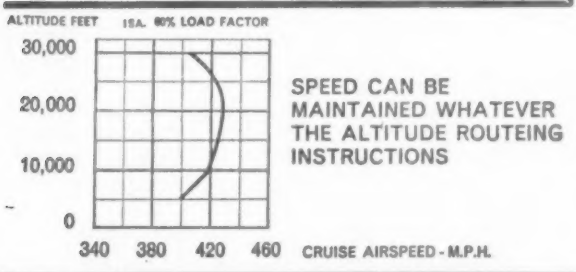
AT 628

Only the VANGUARD
has this proved flexibility

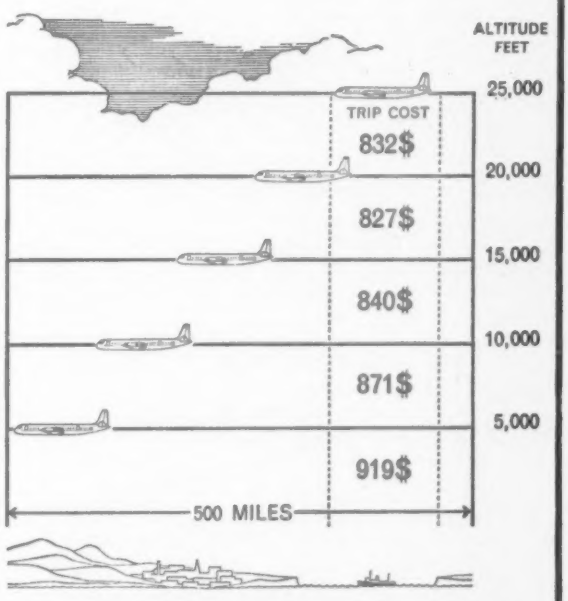
AIRLINE OPERATORS are invited to look carefully at this diagram and graph, and then compare the Vanguard's flexibility with their own experience of short haul operation on high-density routes.

It is easy to see that this remarkable aircraft can be routed at altitudes of from 5,000 ft to 25,000 ft and above, with practically no penalties in operating costs or speed.

The difference in direct cost between a 500-mile sector flown at 10,000 ft and one flown at an optimum of 20,000 ft is only $44 per trip. A cruising speed of over 400 m.p.h. is available between the height bands of 5,000 ft and 30,000 ft., so that schedules can be maintained irrespective of routeing instructions.



SPEED CAN BE MAINTAINED WHATEVER THE ALTITUDE ROUTEING INSTRUCTIONS



LOW LEVEL ROUTEING IMPOSES NO FINANCIAL STRAIN WITH THE VANGUARD

Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 7/8 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

• ***The airliner with the biggest profit potential ever offered to the operator***

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

AT 676

'In the VANGUARD

we have a turbo-prop which is not only much better than specification but is a very cheap aircraft to operate'

Mr. Harold Watkinson, British Minister of Transport and Civil Aviation

THE VANGUARD *is* much better than specification. Proving flights under actual operating conditions have underlined this fact. And it is a very cheap aircraft to operate, with a very low break-even load factor.

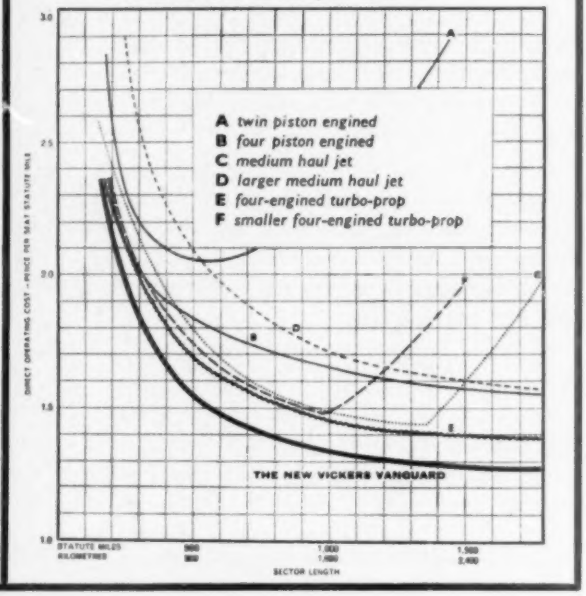
Vickers design philosophy anticipated the inevitable trend towards cheap fares. The Vanguard was therefore engineered for extreme economy in operating costs.

Experience in many parts of the world has proved that cheap fares pay dividends. The Vanguard is ready to turn cheap fare policy into profits on short and medium haul. Airlines which cannot exploit cheap fares will be badly placed.

Cheap fares are not a proposition with old equipment. It is too expensive to operate. It cannot compete with the Vanguard in speed, comfort or glamour. In the cheap fare structure, jets too must give way where short/medium haul is concerned. The Vanguard will operate at half their cost, yet can pace them on block times.

Low operating costs, cheaper fares, more passengers, more profit — that's the air pattern of the future for airlines which operate the Vanguard.

These curves were produced independently by an airline with costs calculated on a European basis.



Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 7 to 8 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

• ***The airliner with the biggest profit potential ever offered to the operator***

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

AT 616A

COMMERCIAL AIRCRAFT OF THE WORLD

IN this 28-page supplement, THE AEROPLANE AND ASTRONAUTICS presents its third annual survey of the World's commercial aircraft. The information presented provides a unique guide to the characteristics of all transport aeroplanes now in production, or on offer to the airlines, as well as the older types still in service.

We have followed, in this supplement, the method of presentation used in the previous editions (April 26, 1957, and July 4, 1958). Thus, each type of transport aircraft in production is illustrated with a photograph and/or three-view general arrangement drawing; these are accompanied by a table of dimensional, weight and performance data, an engineering summary and payload-range and cost curves. The text takes the form of a progress report covering the 15 months since our previous Commercial Aircraft Number appeared. Similar, but slightly condensed, information is included for types on offer to the airlines but not yet ordered.

The supplement describes 30 basic aeroplanes in 50 variants. All the data, curves and information have been thoroughly revised and much is new. Detailed specifications will be found here, for the first time, for the Airco D.H.121, the Vickers V.C.10, the Short Britannic, the turbofan versions of the Boeing 707 and DC-8, the Convair 880 Model 31, the Lockheed Super Hercules and the Sud-Aviation Caravelle VII, among others.

The data presented for each aircraft have been found in practice to give a reliable indication of that aircraft's usefulness, and once again great care has been taken to ensure that the data are directly comparable. For the most part the tables are self-explanatory, but it is to be noted:—

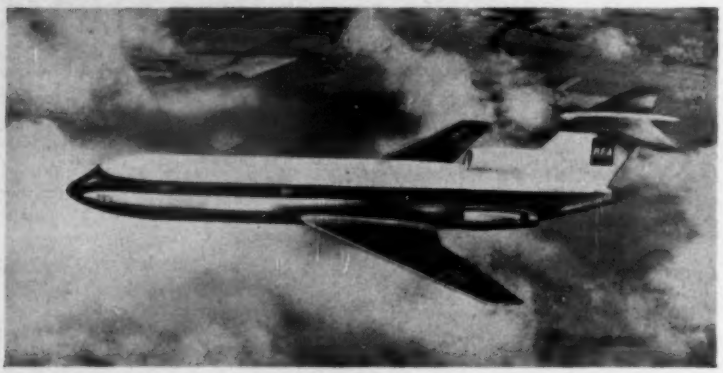
Cabin dimensions refer to the commercially usable capacity and exclude the flight deck. Where capacities of freight and baggage holds are indicated, these are extra to the main cabin volume also quoted.

Basic operational weight is defined as gross weight minus usable fuel and payload. Design limit speeds are normally in knots E.A.S. and in indicated Mach number at higher altitudes.

Approach speed is defined as 1.3 times Vso (stalling speed in landing configuration, knots E.A.S.). Balanced field lengths are to current U.S. or British requirements unless specifically indicated. Quoted ranges, and the range curves, are with allowances for take-off climb, cruise, descent and landing, but with no fuel reserves, unless otherwise shown.

Cost curves are based on the A.T.A. 1955 method, sometimes with small modifications to suit current conditions.

Commercial Aircraft . . . .



The Airco D.H.121

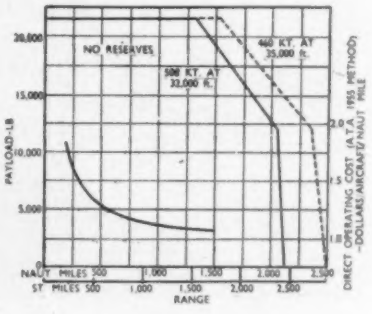
Short-haul turbojet trunk-liner for 1963 delivery. First flight late 1961. In production, 24 ordered.

BRITISH EUROPEAN AIRWAYS obtained the necessary Government approval to negotiate with the Aircraft Manufacturing Co. (Airco) for the purchase of its D.H.121 short-haul turbojet design in February, 1958. This was 18 months after B.E.A. had issued an Outline Specification to the industry and six months after a technical decision in favour of the D.H.121 had been made. Another 18 months elapsed, after Government approval had been obtained, before the specification of the D.H.121 was agreed in detail, and the contract for 24 aircraft, valued, with spares, at nearly £28 million, was not signed until August 12 this year.

An outline of the history of the D.H.121 appeared in THE AEROPLANE AND ASTRONAUTICS for August 28, and explained how certain factors led to the design being stretched in weight, power, range and capacity. This growth was considered undesirable by the makers, and the aeroplane as now ordered by B.E.A. is back roughly where it started, as a genuine short-haul design generating its lowest seat-mile costs over 800 naut. mile stages and able to carry a capacity 79-passenger payload over 1,000 naut. miles.

The Airco D.H.121 is a private-venture development, as are its Rolls-Royce R.B.163 by-pass engines. The Airco consortium is made up of the de Havilland Aircraft (67½%) with overall design responsibility; Hunting Aircraft (22½%) and Fairey Aviation (10%). Technical teams from the latter two companies have been based at Hatfield while the main design decisions were reached, preliminary wind-tunnel tests completed and overall applied loads and type of structure established. Hunting Aircraft is now responsible for the detail design, testing and production of the outer wing and portions of the flap, while the Fairey team has similar responsibility for the entire empennage and the three-channel power flying-control units.

Some preliminary test work on D.H.121 structure has already been done, and a complete nose section with cockpit and canopy has been built for structural testing. Construction of components for the first aircraft has begun. The first flight is scheduled for the latter part of 1961, with deliveries to B.E.A. starting in the last quarter of 1963—and to other operators immediately thereafter. Deliveries to B.E.A. will be in three batches—in 1963, 1964 and 1965.



Dimensions
Span: 90 ft. 0 in.
Overall length: 104 ft. 0 in.
Overall height: 27 ft. 6 in.
Gross wing area: 1,350 sq. ft.
Sweepback: 35° on 25% chord.
Internal cabin dimensions:
Length (ex. flight deck): 66 ft. 10½ in. (65 ft. 8 in. on port side).
Max. width: 136.3 in.
Max. height: 80 in.
Max. usable floor area (ex. flight deck): 708 sq. ft.
Max. usable volume (ex. flight deck): 4,440 cu. ft.

Accommodation
Normal mixed class: 83 (6 abreast).
Max. coach: 100 (6 abreast).
Volume of freight and baggage holds: 620 cu. ft. (2).

Powerplants
Three Rolls-Royce R.B.163-1 by-pass turbojets.
Take-off power each (I.S.A., s.l.): 10,100 lb.s.t. at 12,410 r.p.m.
Silencers all engines, reversers two outers.

Weights and Loadings
Basic operational: 63,200 lb.
Total fuel: 30,700 lb.
Mfrs. max. payload: 21,500 lb.
Max. take-off: 105,000 lb.
Max. landing: 100,000 lb.
Max. zero fuel: 85,500 lb.
Wing loading (max. t.-o. wt.): 77.8 lb./sq. ft.
Wing loading (max. landing wt.): 74.1 lb./sq. ft.
Power loading (max. t.-o. wt.): 3.46 lb./lb.s.t.

Design Criteria
Design limit speed E.A.S.: Mc/Vc=0.815/360 k. Md/Vd=0.95/415 k.

Performance
Recommended cont. cruising speed (I.S.A.): 508 knots (at 32,000 ft. and 100,000 lb.); consumption: 918 Imp. gal./hr.
Approach speed (at max. landing wt.): 134 knots.
Balanced field lengths (at max. t.-o. wt.):
At I.S.A. at sea level: 6,000 ft.
At I.S.A. +15°C. at sea level: 6,700 ft.
At I.S.A. at 5,000 ft.: 8,250 ft.
Landing distance (SR 422A, max. landing wt.): 3,760 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (3,840 Imp. gal.): 2,350 naut. mi. with 12,000 lb. payload at 459 knots (mean) at 35,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max. payload: 1,530 naut. mi.

Structure: Circular-section monocoque fuselage. Two-spar wing with third spar over centre section and inner wings. Integral fuel tanks. Fail-safe design supported by safe-life structure where necessary. Naturally aged aluminium-copper alloys for skins and stringers.

Undercarriage: Four-abreast main wheel units, pivot through 90° and fold sideways into fuselage. Offset twin nosewheel retracts sideways. Track 18 ft. 8 in. Wheelbase 43 ft. 6 in.

Flaps and Slats: Double slotted flaps in two pieces each side, and interconnected drooping leading edge. Lift dumpers forward of inner flap section.

Air Brakes: Spoilers ahead of outer flap sections, supplemented in the air by u/c and reverse thrust.

Flying Controls: Ailerons in two sections: inners only at high speed. All-moving tailplane with geared elevator. All controls fully powered with triplicated hydraulic units close to the surfaces.

Systems: Three independent 3,000 p.s.i. hydraulic systems powered by three engine-driven pumps, with independent stand-by, to operate flying controls, u/c, brakes, flaps, slats, air brakes and lift dumpers. Three AC generators driven by engine-mounted hydraulic constant-speed drives provide 400 cycle 3-phase 115/200V AC electrics and, through three rectifiers, 28V DC. Air conditioning by engine-bleed air; provision for A.P.U. for ground use. Cabin differential 8.25 p.s.i. Airframe de-icing, including engine and air intakes, by engine-bleed air. Electric film windscreen de-icing.

The Armstrong Whitworth Argosy

Medium-haul turboprop freighter-coach for 1960 delivery. First flight January, 1959. In production; about 40 on option

IN 10 months, Armstrong Whitworth have flown six of the initial batch of 10 A.W.650s, and by so doing have set a record for the production of a new civil aircraft in Britain. The flight test programme is well up to schedule and hours are now expected to build up rather more quickly than at first planned. The total at mid-September was over 500 hours by the first five aircraft. The sixth Argosy flew on September 24.

Although the first four aircraft are regarded as preproduction models, all are being maintained at the current modification standard and the first true production model, seen in the S.B.A.C. flying display at Farnborough this year, shows no modifications. Indeed, since the first flight on January 8, almost the only major difficulty has been some aerodynamic buffet, which has been fixed by two rows of vortex generators on the rear cockpit decking and a breaker-strip round the rear clamshell door.

Certification, both by the A.R.B. and the F.A.A., is scheduled for next March, and will be completed by the first three aircraft. Of these, the second left Britain for tropical trials at Khartoum and Nairobi on August 30, and is due back early next month after some 200 hours of trials. The third Argosy is now being used mostly for detailed performance testing, and the fourth is earmarked as the sales demonstrator; the first overseas demonstration flights were made earlier this month.

In addition to the aircraft on flight test, Armstrong Whitworth have two complete test specimens—one static and one fatigue. The wing (which has been designed by Avro as their Type 733) has so far been taken to 85% of critical design load, and over 5,000 hours of simulated fatigue loading has been completed in a programme which will eventually total 150,000 hours.

The first operator to announce firm interest in the £460,000 Argosy was Riddle Airlines, which placed a provisional order for four in February, for delivery next year. Other options and letters of intent held by Armstrong Whitworth account for seven of the first batch of 10 (i.e., all but the three test aircraft), and for a total of some 40 Argosies for delivery in 1960. A contract for 20 A.W.660 100,000-lb. military tactical freighters was placed by Transport Command, R.A.F., in August, and the third version, the A.W.670 car ferry, is still a current project. A specification of the A.W.670 appears here together with data on the A.W.650 Argosy itself.

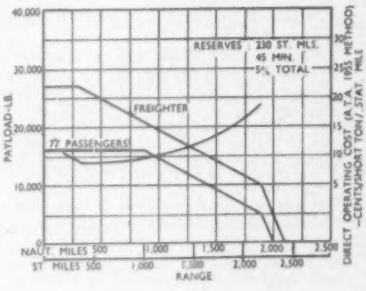
Structure: Two-spar, mass-boom wing in five sections. Semi-monocoque open-ended fuselage. Twin tail booms.

Undercarriage: Retractable tricycle with twin main and nose wheels. Steerable nose-wheel.

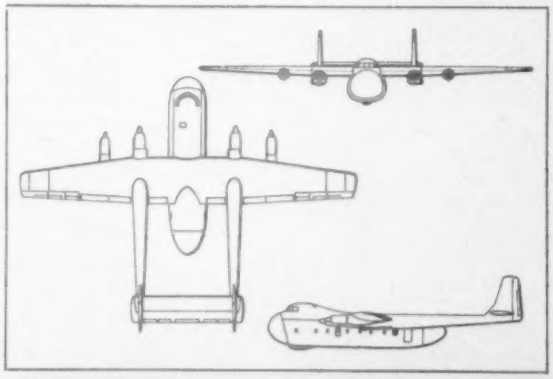
Flaps: Double-slotted in six sections.

Flying Controls: Manually operated with spring and geared tabs. Lockable from control cabin.

Systems: Undercarriage, nose-wheel steering, brakes and flaps by 2,500–3,000 p.s.i. hydraulic system supplied by three engine-driven pumps. Emergency by self-contained electric power pack and reservoir for flaps and undercarriage up-locks, doors and nose-wheel lowering. The main undercarriage units are of the free-fall type. DC electrical supply from four 6 kW engine-driven generators; AC from two invertors with stand-bys. Three alternators for de-icing supplies. Cabin air at 5.5 p.s.i. from three engine-driven blowers. De-icing by two exhaust heat-exchangers for main plane and by electric heaters for tail unit, engine intakes, propellers and screen. Fuel from 10 bag tanks in wing.



	A.W. 650	A.W. 670
Dimensions :		
Wing span, ft. in.	115 0	115 0
Overall length, ft. in.	86 9	86 9
Overall height, ft. in.	27 0	27 0
Gross wing area, sq. ft.	1,458	1,458
Sweepback	Nil	Nil
Internal cabin dimensions, ex. flight deck:		
Length, ft. in.	46 8	42 0
Max. width, in.	120	180
Max. height, in.	80	84
Max. usable floor area, sq. ft.	426	610
Max. usable volume, cu. ft.	3,680	4,260
Volume of baggage and freight holds, cu. ft.	Nil	Nil
Accommodation :		
Normal first class	71	—
Normal tourist	77	116
Max. coach	83	126
Powerplants :		
Type and number	4 Dart 526	4 Dart 526
Rated t.-o. power (i.s.a., s.l.), e.h.p./r.p.m.	2,100/15,000	2,100/15,000
Propeller type and dia., ft. in.	Rotol, 11 6	Rotol, 11 6
Weights and loadings :		
Basic operational weight, lb.	47,000	46,400
Total fuel, lb.	26,400	26,400
Mfrs. max. payload, lb.	27,000	28,000
Max. take-off, lb.	82,000	82,000
Max. landing, lb.	78,000	78,000
Max. zero fuel, lb.	74,000	74,000
Wing loading, max. t.-o. wt., lb./sq. ft.	56.2	56.2
Wing loading, max. landing wt., lb./sq. ft.	53.5	53.5
Power loading, max. t.-o. wt., lb./e.h.p.	9.8	9.8
Design limit speeds :		
Vc, knots E.A.S.	230	230
Vne, knots E.A.S.	256	256
Vd, knots E.A.S.	291	291
Performance :		
Recommended cont. cruising speed, knots	263	239
At altitude, ft./weight, lb.	20,000/70,000	10,000/70,000
With consumption, Imp. gal. p.hr./r.p.m.	360/14,200	458/13,600
Approach speed (1.3 Vso), max. landing wt., knots	130	106
Balanced field length (SR422A), max. t.-o. wt.:		
I.S.A. at s.l., ft.	4,080	4,400
I.S.A.+15°C. at s.l., ft.	4,380	4,730
I.S.A. at 5,000 ft.	5,500	6,120
Landing distance required (50% factor), ft.	4,480	5,480
Range with max. fuel, t.-o. to landing, no reserves, still air, I.S.A., naut. miles	2,530	1,620
With payload, lb./fuel, Imp. gal.	8,600/3,300	9,000/3,300
At mean speed, knots/altitude, ft.	257/24,000	240,10,000
Range with max. payload, naut. miles	620	400



Commercial Aircraft . . . .

The AVRO 748

Short-haul turboprop feederliner for 1961 delivery; first flight Feb., 1960. In production; more than 12 ordered

AVRO'S decision to proceed with the development of the 748 was taken at the beginning of January this year, after about 18 months of general design investigation and a market survey towards the end of 1958. From the start, an exceedingly tight schedule has been attempted, with 12 months allowed from the cutting of metal to the target first-flight date at the end of February, 1960. The intention is to use the first and second aircraft (the latter to fly in August, 1960) for certification trials, due for completion at the end of 1,000 hours in March, 1961. Production aircraft should be in service in the latter half of 1961.

The initial development programme involves four complete aircraft of which the first and third are flying prototypes, the second for structural test and the fourth for water-tank fatigue test. Work has now been started on a further batch of 10 production aircraft, and three sets of jigs will be laid down for production, including those used for the prototypes. Up to 20 production aircraft can be delivered by the end of 1961.

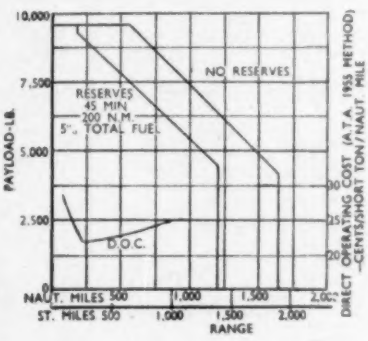
The Hawker Siddeley-sponsored development programme is estimated to cost £2¼ million. First support for the project came from Skyways, with a "letter of intent" for three, and from the Indian Government. The prospect of an Indian order was, in fact, a major consideration in going ahead with the project. In the face of competition from British, Dutch and American manufacturers, Avro obtained a contract (conditional upon satisfactory performance of the aircraft) for the construction of a military version of the 748 for the Indian Air Force, and for technical support in establishing a 748 production unit at Kanpur.

Details tabulated are for the basic commercial 748, with a selling price of £170,000 less radio. The military model will have such modifications as a freight floor, larger rear door for freight loading and air dropping, revised flight deck providing for radio operator and navigator in addition to two pilots, and gross weight increased to about 36,000-40,000 lb. Avro have also studied the effect of fitting 2,105-e.h.p. Dart 529 (R.Da7) engines. This serves to improve the airfield, climb and cruise performance, with slight reductions in range with given payloads.

Order Summary

(With dates of first deliveries)

Skyways, 3 (provisional), 1961; Indian Air Force, about 10, 1961; Ministry of Supply, 3, 1961; B.K.S. Air Transport, 3 (+2), early 1961.



Dimensions
- Span: 95 ft. 0 in.
- Overall length: 67 ft. 0 in.
- Overall height: 24 ft. 10½ in.
- Gross wing area: 795 sq. ft.
- Sweepback: Nil.
- Internal cabin dimensions:
  - Length (ex. flight deck): 46 ft. 6 in.
  - Max. width: 97.2 in.
  - Max. height: 76.6 in.
  - Max. usable floor area (ex. flight deck): 296 sq. ft.
  - Max. usable volume (ex. flight deck): 1,990 cu. ft.

Accommodation
- Normal tourist: 36 (4 abreast)
- Max. coach: 44 (4 abreast)
- Volume of freight and baggage holds: Nil.

Powerplants
- Two Rolls-Royce Dart 514 (R.Da.6).
- Take-off power each (I.S.A., s.l.): 1,740 e.h.p. at 14,500 r.p.m.
- Rotol c.s., f.f. four-bladed propellers, 12 ft. diameter.

Weights and Loadings
- Basic operational: 19,444 lb.
- Total fuel: 8,910 lb.
- Mfrs. max. payload: 10,000 lb.
- Max. take-off: 33,000 lb.
- Max. landing: 33,000 lb.
- Max. zero fuel: 29,110 lb.
- Wing loading (max. t-o.wt.): 41.5 lb./sq. ft.
- Power loading (max. t-o.wt.): 9.5 lb./e.h.p.

Design Limit Speeds
- V_c=225 k. E.A.S. V_{ne}=270 k. E.A.S.
- V_d=300 k. E.A.S.

Performance
- Cont. cruising speed (I.S.A.): 230 knots (at 20,000 ft. and 31,000 lb.); consumption: 0.675 lb./s.h.p./hr.
- Approach speed (1·3V_{so}) max. landing wt.: 91.9 knots.
- Landing distance from 50 ft. (unfactored, max. landing wt.): 2,310 ft.
- Balanced field lengths (at max. t-o.wt.):—
  - At I.S.A. at sea level: 3,500 ft.
  - At I.S.A. +15°C at sea level: 3,750 ft.
  - At I.S.A. at 5,000 ft.: 4,750 ft.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (1,100 Imp. gal.): 1,630 naut. mi. with 4,420 lb. payload at 230 knots (mean) at 20,000 ft. (mean).
- Range (take-off to landing) still air, no reserves, I.S.A., with max. payload: 580 naut. mi.

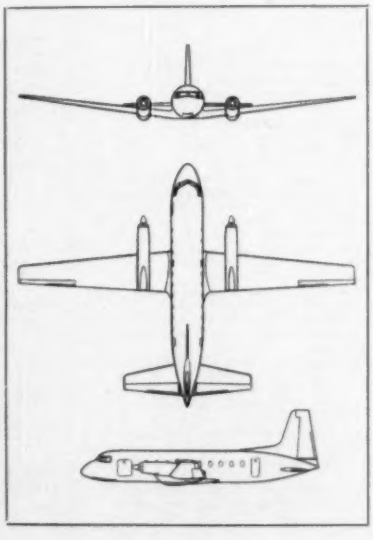
Structure: Two-spar wing in one piece each side, attaching to integral wing/fuselage centre section. Integral fuel tanks outboard of engines. Circular section fuselage. Principal materials, L.65, L.72, L.73 and L.77 aluminium alloys.

Undercarriage: Twin-wheel main units retracting forwards into nacelles. Twin-wheel steerable nose-wheel retracting forwards into fuselage. Hydraulic brakes.

Flaps: Fowler type in one piece each side, with additional trailing edge tab to increase drag in landing configuration. Electrically operated.

Flying Controls: All manual, with set-back hinges, and horn-balanced rudder. Gear tab on each aileron and trim tab on one. Gear trim tabs on both elevators. Separate spring and trim tabs on rudder.

Systems: 2,500 p.s.i. hydraulic system powered by two engine-driven pumps for u/c, brakes, nose-wheel steering and optional propeller brakes (plus manual emergency pump for u/c). Primary 28 v. DC electric system from two engine-driven generators, plus two alternators for 115 v. AC and a third alternator for 200 v. AC for engine and propeller de-icing. Cabin pressurization at 4.2 p.s.i. by engine-driven blowers. De-icing of wing and tail unit by chordwise rubber boots energized by compressor bleed air.



MUCH MORE ENERGY FOR MUCH LESS WEIGHT

New Bristol Aerojet process produces gas storage vessels of great strength—high capacity—exceptionally low weight

High-pressure gas storage bottles have become an essential part of aircraft and guided missile systems. They provide a compact and efficient method of storing energy.

Bristol Aerojet, specialists in the design and manufacture of high tensile steel welded components, have developed a very advanced range of pressure vessels. Operating with great reliability at high stress levels, this new design provides unusually high energy storage capacity for exceptionally low weight.

Made of chrome molybdenum steel, the vessels are welded by the argon shielded tungsten arc process and heat treated to a minimum ultimate strength of 75 tons per sq in. All welds are examined several times during manufacture, both visually and radiographically and are subjected to the same stress as the parent material.

Bristol Aerojet pressure vessels are made in many specified shapes and range from 100 to 2,000-cu in capacity. When compared to forged vessels they show a weight saving of at least 5 lb per 500 cu in and as much as 50%.

Bristol Aerojet Pressure Vessels Specified For Trans-Canada Vanguards

Trans-Canada Airlines have chosen Bristol Aerojet pressure vessels for the Elliot escape chutes in their 20 Vanguards.

Other companies supplied include:

BRISTOL AIRCRAFT LIMITED
BRISTOL SIDDELEY ENGINES LIMITED
DE HAVILLAND PROPELLERS LIMITED
WALTER KIDDE CO. LIMITED
BRITISH MESSIER LIMITED
THE PYRENE CO. LIMITED
A. V. ROE & CO. LIMITED
SAUNDERS-ROE LIMITED
SHORT BROS. & HARLAND LIMITED
VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED

If you would like further information, about Bristol Aerojet pressure vessels or high tensile steel welded components, please write to: P. W. Lawson, Civil Sales Manager, Bristol Aerojet Limited, Banwell, Weston-Super-Mare, England. Telephone: Banwell 250.

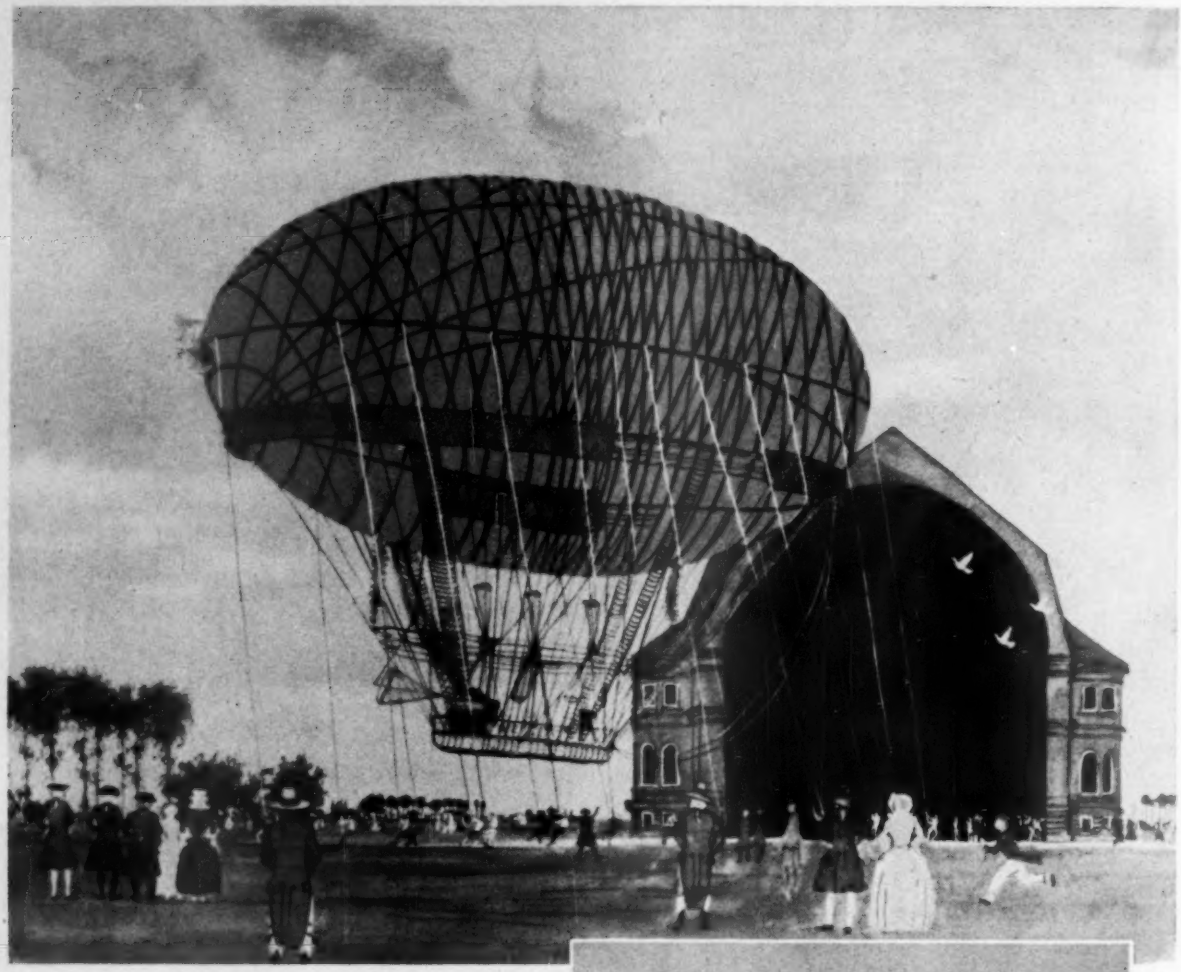
Type 3135 Pressure Vessel Cylindrical (525 cu in)

Design ultimate pressure	5,000 psi
Maximum inflation pressure	2,500 psi
Free gas volume	1,470 litres
Weight	12 lb

ARB approved
Suitable for CO_2 fire extinguishers and pneumatic systems.

BRISTOL AEROJET

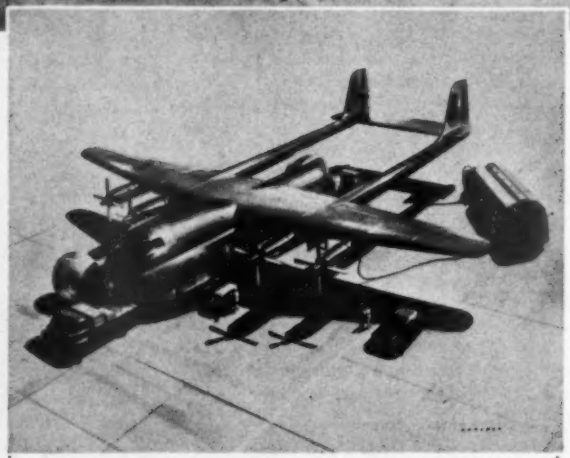
Propulsion through the ages...



An Army Visionary of the 18th Century

In 1784, only a year after the invention of the balloon, J. B. M. Meusnier, a French Army Officer, designed a dirigible airship which in all essentials anticipated those of the 20th century. Meusnier planned a proper hangar for his airship—and also a light-weight folding shelter for use on military operations away from base. The beautifully executed design drawings (still preserved in France) show in detail the features pictured in this imaginary scene—the elongated envelope; gondola; manually-operated propellers; and rudder.

The impressive sight above was seen only in the mind's eye of the artist—but Meusnier and others like him laid the foundations of the Air Age; even as Rotol played a major part in the development of the turbo-propeller airliners of to-day.



ARMSTRONG WHITWORTH ARGOSY

Rotol propellers, gearboxes, and accessory drive equipment help to make this "private venture" plane (23 months from drawing-board to take-off) so successful. A military version is on order for the Royal Air Force.

ROTOL ROTOL LIMITED · GLOUCESTER · ENGLAND

A member of The Dowty Group

PT/4

Commercial Aircraft . . . .

Medium and long-haul turboprop trunk-liner, in service since 1957. *First flown August,* 1952. *Production ending ; 79 ordered.*

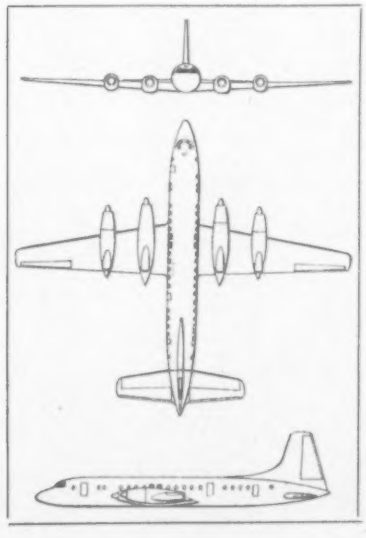
The Bristol Britannia

WORK on the Britannia is now concentrated upon the remainder of the 253s for Transport Command. Of these, Short Bros. and Harland are building 15 and Bristol is building five. Before the year's end, Bristol will also be completing and delivering two 305s to Transcontinental S.A. and two 324s to C.P.A.; the former were built originally for Northeast Airlines and the latter—the only Series 320 Britannias (data below)—were built speculatively at the end of the production run.

During the past year or so the Britannia has continued in service with B.O.A.C., El Al, and Aeronaves, all of which started operations with this type in 1957. C.P.A. began operating its Britannias on June 1, 1958, followed early this year by Cubana, which has become the third Britannia operator on the Atlantic. Air Charter acquired the first of its two Britannias in September, 1958, and has been responsible for some outstanding long-distance flights on trooping operations; similarly, Hunting-Clan has been using its Britannias for trooping (for which the company now has almost a monopoly) since May 15 this year.

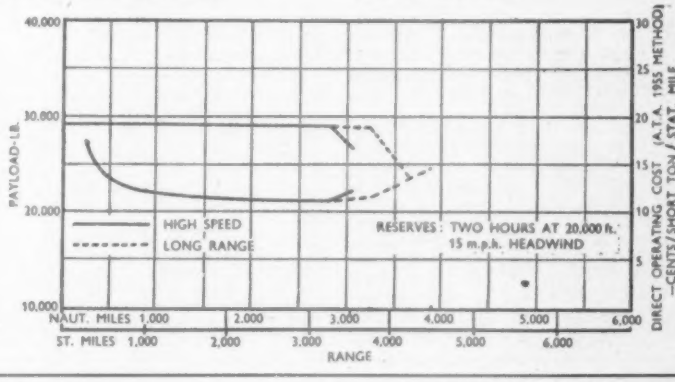
The total number of Britannia airline operators is, in fact, now 13; in addition to those listed below, Mexicana flies in conjunction with Aeronaves and Central African, East African, Nigeria and Ghana Airways all fly Britannia services, in association with B.O.A.C.

Briefly, the different types of Britannia in service are as follow: **Series 100,** the original medium-range version, with 3,900-e.h.p. Proteus 705s and 155,000-lb. gross weight (data, THE AEROPLANE, July 4, 1958); **Series 250,** military cargo/passenger version with 4,445-e.h.p. Proteus 225 and weights and performance similar to the 320; **Series 300,** the first long-fuselage variant with 4,160-e.h.p. Proteus 755s and 165,000-lb. weight; **Series 305,** which is the 300 brought up to 310 standard with extra fuel and higher weights; **Series 310,** with centre-section tankage and 185,000-lb. weight; and **Series 320** with Proteus 765s and all the latest refinements.



Order Summary
(With dates of first delivery)

B.O.A.C., 15 Model 102, Dec., 1955; B.O.A.C., 17 Model 312, Dec., 1957; El Al 4 Model 313, Sept., 1957; C.P.A., 6 Model 314, April, 1958; C.P.A., 2 Model 324, Oct., 1959; Hunting-Clan, 2 Model 317, Sept., 1958; Aeronaves, 2 Model 302, Nov., 1957; Cubana, 4 Model 318, Dec., 1958; Air Charter, 2 Model 307, Sept., 1958; Transcontinental, 2 Model 305, Oct., 1959; R.A.F., 20 Model 253, June, 1959; R.A.F., 3 Model 252, 1959.



Dimensions
Span: 142 ft. 3½ in.
Overall length: 124 ft. 3 in.
Overall height: 37 ft. 6 in.
Gross wing area: 2,075 sq. ft.
Sweepback: nil.
Internal cabin dimensions:
Length (ex. flight deck): 80 ft. 3 in.
Max. width: 139 in.
Max. height: 80 in.
Max. usable floor area (ex. flight deck): 883 sq. ft.
Max. usable volume (ex. flight deck): 5,877 cu. ft.

Accommodation
Normal first-class: 82 (4 abreast).
Normal tourist: 110 (6 abreast).
Max. coach 149 (6 abreast).
Volume of freight and baggage holds: 829 cu. ft. (2)

Powerplants
Four Bristol Proteus 765.
Take-off power each (I.S.A., s.l.): 4,445 e.h.p. at 11,775 r.p.m.
De Havilland c.s., f.f. four-blade 16-ft. diameter propellers.

Weights and Loadings
Basic operational: 93,631 lb.
Total fuel: 68,640 lb.
Mfrs. max. payload: 34,369 lb.
Max. take-off: 185,000 lb.
Max. landing: 137,000 lb.
Max. zero fuel: 128,000 lb.
Wing loading (max. t.-o. wt.): 89.2 lb./sq. ft.
Wing loading (max. landing wt.): 66.0 lb./sq. ft.
Power loading (max. t.-o. wt.): 10.4 lb./e.h.p.

Design Criteria
Design limits:Mc/Vc: 0.6/258k. Mne/Vne: 0.65/288 k. Md/Vd: 0.7/320 k. I.A.S.

Performance
Recommended cont. cruising speed (I.S.A.): 345 knots (at 22,000 ft. and 150,000 lb.); consumption: 737 Imp. gal./hr.; power (per engine): Max. continuous.
Approach speed (at max. landing wt.): 114.4 knots.
Balanced field lengths (at max. t.-o. wt.):
At I.S.A. at sea level: 8,150 ft.
At I.S.A. +15°C. at sea level: 9,600 ft.
At I.S.A. at 5,000 ft.: 11,600 ft.
Landing distance (max. landing wt.): 6,000 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (8,580 Imp. gal.): 4,530 naut. mi. with 23,000 lb. payload at 310 knots (mean) at 28,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max. payload: 3,620 naut. mi.

Structure: Box spar wing in two main units, joined at centre line of fuselage. Detachable wing tips. Structural weight less than 25% of basic weight. Semi monocoque fuselage. Integral and bag-type fuel tanks.

Landing Gear: Four-wheel bogie main units and twin-wheel, steerable nose unit. Disc brakes.

Flaps: Double-slotted Fowler-type, electrically operated.

Flying Controls: Aerodynamic full-servo type operated by tabs on each surface. Spring-feel for ailerons and rudder; "q" feel for elevators.

Systems: 4,000 p.s.i. hydraulic for landing gear, wheel brakes, nose-wheel steering and control-system ground locks. Separate hydraulic system for "q" feel and control damping.
Four electrically driven pumps and accumulators which can be off-loaded from the system at all times except take-off and landing. Electrical supply from four 47 kVA. cooled three-phase alternators and transformer rectifying units are 208V. AC, 112 and 28V. DC. Electrical load can be carried by any two engines, feeding busbars, all essential services can be maintained even after split busbar operation. Five invertors for radio and instruments fed from MV 112V. busbar. Cabin differential pressure up to 8.3 p.s.i. tapped from engine compressors.
De-icing of wing and engine intakes by hot gas from turbine and by electrically heated spray mats on tailplane, fin and elevator horn balances. Propellers and windscreen by electrical elements.

Commercial Aircraft . . . .

Medium-haul turbojet trunk-liner, in service Oct., 1958. First flight (Series 4) April, 1958. In production, 36 ordered.

The de Havilland Comet

THE past 12 months have been significant ones for the Comet, which went into service with B.O.A.C. on the North Atlantic on October 4, 1958, and thus became the first jet transport in the World to operate on this route. The Comet 4 first flew on April 27, 1958, and obtained an unrestricted British C. of A. on September 30. Following its introduction on the North Atlantic, at first on a weekly and later on a daily service both to New York and to Montreal, the Comet was put on B.O.A.C.'s Far East route to Tokyo on April 1, 1959.

With the fleet of 19 now almost completely delivered, B.O.A.C. will introduce Comets on the Kangaroo route to Australia on November 4, the South African route on December 2, and the South American services on January 25, 1960. Aerolineas Argentinas began operations with the Comet on April 16.

The first Comet 4B for B.E.A. flew on June 27, 1959, and is distinguished by its longer fuselage and shorter-span wings without pinion tanks. Deliveries are to begin this month for services early next year.

In addition to these two Comet variants, the Comet 4C is still on offer and at least one airline may purchase this version in the near future. The Comet 4C is a 4B fuselage with the same wing, fuel capacity and gross weight as the Comet 4. It can carry its 24,600-lb. payload over a distance of 3,140 naut. miles (no reserves), or a 13,800-lb. payload over 3,890 naut. miles (no reserves). Both the Comet 4C and the Comet 4 benefit from the recent 4,000-lb. increase in gross weight, but this increase is not applicable to Comet 4s already flying. It is achieved by standardizing in the other two variants the strong stub-wing developed for the Comet 4B.

Order Summary

(With dates of first deliveries)

B.O.A.C., 19 Series 4, September 30, 1958; B.E.A., 7 Series 4B, October, 1959; Aerolineas Argentinas, 6 Series 4, March, 1959; East African Airways, 2 Series 4, June, 1960; Olympic Airways, 2 Series 4B, early 1960.

Structure: Wing made up of centre section, two stub wings and two extension wings. Two-spar construction inboard, semi-monocoque outboard. Integral fuel tanks in stub and extension wings and nacelle tanks. Semi-monocoque fuselage "lifed" to more than 200,000 hours (unfactored).

Undercarriage: Four-wheel bogie main units and two-wheel steerable nose unit.

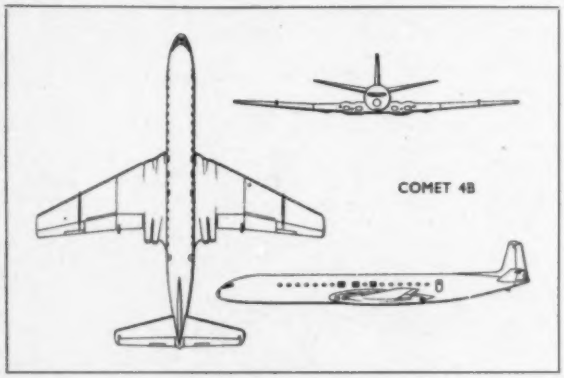
Flaps: Plain outer pairs and split-type inner pairs.

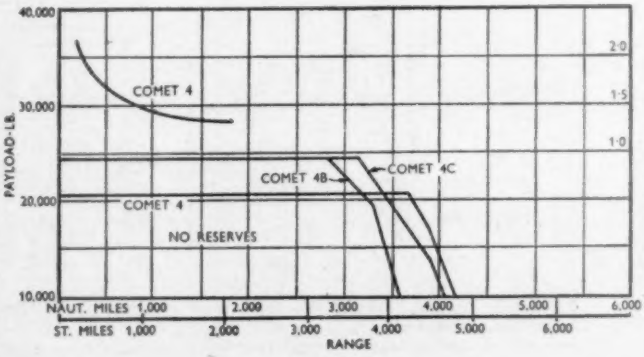
Air Brakes: Slotted plates above and below each wing.

Flying Controls: Fully power-operated by duplicated hydraulic and mechanical units and three separate sources of hydraulics. The ailerons incorporate spring-feel only; the elevator spring-feel plus "q" feel; and the rudder spring-feel "q" restrictor. Two-speed gearing for the elevators.

Systems: Four-circuit (plus handpump) 2,500-p.s.i. four-engine-pump hydraulic system (with two electric-motor-driven pumps as reserve) for flying controls, undercarriage, flaps, air brakes, wheel-brakes and nose-wheel steering. Electrical supply from four 14 kVA alternator/rectifier combinations to busbar system normally single, but divisible under fault conditions. Cabin air (at 8.75 p.s.i.) tapped from last-stage compressors of all engines. De-icing of wings, tailplane, fin and engine-intakes by hot air from engine compressors of all engines.

	Mark 4	Mark 4B
Dimensions :		
Wing span, ft. in.	114 9	107 10
Overall length, ft. in.	111 6	118 0
Overall height, ft. in.	29 6	29 6
Gross wing area, sq. ft.	2,121	2,059
Sweepback, deg. at 25% chord	20	20
Internal cabin dimensions, ex. flight deck :		
Length, ft.	71.73	78.23
Max. width, in.	115.7	117
Max. height, in.	78.7	78.5
Max. usable floor area, sq. ft.	439	529
Max. usable volume, cu. ft.	2,815	3,160
Volume of baggage and freight holds, cu. ft.	570 (3)	640 (3)
Accommodation :		
Normal first class	60	72
Normal tourist	79	92
Max. coach	81	102
Powerplants :		
Type and number	4 Avon 524	4 Avon 525B
Rated t.-o. power (i.s.a. at s.l.), lb.s.t./r.p.m.	10,500/8,000	10,500/8,000
Weights and loadings :		
Basic operational weight, lb.	74,900	77,200
Total usable fuel, lb.	71,200	62,400
Mfrs. max. capacity payload, lb.	20,300	24,600
Max. take-off, lb.	162,000	158,000
Max. landing, lb.	120,000	120,000
Max. zero fuel, lb.	99,000	102,500
Wing loading, max. t.-o. wt., lb./sq. ft.	76.4	76.7
Wing loading, max. landing wt., lb./sq. ft.	56.6	58.2
Power loading, max. t.-o. wt., lb./lb.s.t.	3.86	3.76
Design limit speeds :		
Mc/Vc (knots E.A.S.)	0.76/280	0.76/325
Mne/Vne (knots I.A.S.)	0.78/320	0.77/355
Md/Vd (knots E.A.S.)	0.84/360	0.84/405
Performance :		
Recommended cont. cruising speed, knots	448	462
At altitude, ft./weight, lb.	28,500/135,000	23,500/135,000
With consumption, Imp. gal./hr.	1,140	1,430
Approach speed (1.3 Vso), knots/at weight	115/100,000	120/110,000
Balanced field length, at max. t.-o. wt.:		
I.S.A. at s.l., ft.	6,750	6,600
I.S.A. +15°C. at s.l., ft.	7,500	7,450
I.S.A. at 5,000 ft.	9,300	9,300
Landing distance required (SR.422A):		
At max. landing wt., ft.	6,630	6,660
Range with max. fuel, t.-o. to landing, no reserves, still air, I.S.A., naut. miles	3,920	3,300
With payload, lb./fuel, Imp. gal.	16,400/8,900	19,100/7,800
At mean speed, knots/altitude, ft.	405/37,000	405/37,000
Range with max. payload, naut. miles	3,640	2,920





AIRCO D.H.121

air-conditioning system engineered by

DE HAVILLAND PROPELLERS LIMITED

ARMSTRONG
WHITWORTH
'ARGOSY'

DOWTY
Equipped

Undercarriages · Propellers · Hydraulics · Electrics

DOWTY GROUP LIMITED · CHELTENHAM

Commercial Aircraft . . .

The Fairey Rotodyne

Short-haul VTOL airliner, for service in 1964. First flown November, 1957. Twelve ordered.

UNIQUELY among the aircraft described in this supplement, the Rotodyne is, in the true sense, a convertiplane in which features of the helicopter and the fixed-wing aeroplane are combined. This principle, which is an extension of that tested in the Fairey Gyrodyne some years ago, has been proved with the prototype Rotodyne (built under M.o.S. contract) which made its first flight on November 6, 1957.

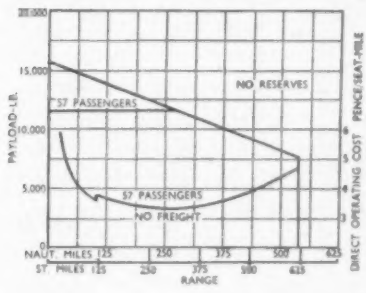
Powered by two 2,800-s.h.p. Napier Eland engines and with a gross weight of 38,000 lb., this prototype achieved its first complete transition from vertical to horizontal flight, with the rotor autorotating, in April, 1958. By August this year it had flown 95 hours in 270 flights.

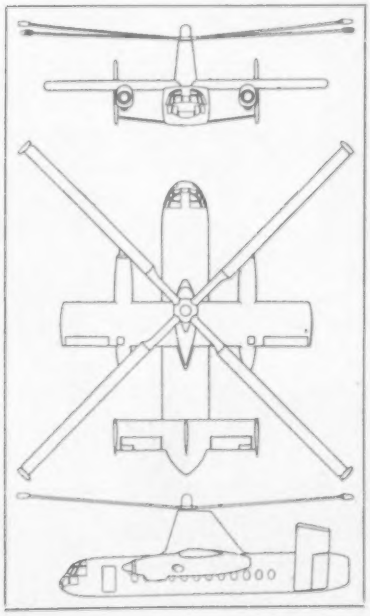
Having thus proved the principle, Faireys have now developed the Rotodyne design into what promises to become one of the first VTOL airliners with operating costs comparable to those of equivalent fixed-wing types. This production version is similar in appearance to the prototype and is shown in the 3-view G.A. on this page. Its new features are a larger rotor diameter, greater wing span, longer fuselage of greater cross section, 5,250-s.h.p. Rolls-Royce Tyne engines replacing the Elands, a central fin, greater weight and generally improved performance.

Airline interest in the Rotodyne has been considerable, but not until March this year was there news of this interest taking the form of an order. In that month, New York Airways announced an order for five with an option on 15 more, subject to suitable arrangements being made for development costs to be covered. British European Airways placed a letter of intent to order six (with options up to 20), with a similar proviso. Okanagan Helicopters has ordered one.

At the end of August, Fairey Aviation was able to announce that it now had a Government contract covering development of the Tyne-engined version, which is to fly before the end of 1961. Moreover, the Ministry of Supply is negotiating for the purchase of a quantity of Rotodynes for military use (when the gross weight will increase to 60,000 lb. and rear-loading doors will be provided). As a result of these arrangements, B.E.A. has entered into direct negotiations with the company with a view to placing an order. Airline deliveries are expected to begin in 1964.

Fairey estimates show that the Rotodyne can be expected to operate with 45-50% load factors, at about 110% of current first-class fixed-wing fares plus airport bus fares—the 10% being the premium to be paid for the time saved in centre-to-centre operations. These operating-cost estimates are based on 2,250 hours a year and seven years' depreciation to 25% of first value.





Dimensions
- Span: 56 ft. 6 in.
- Rotor diameter: 104 ft. 0 in.
- Fuselage length: 66 ft. 1 in.
- Overall height: 26 ft. 0 in.
- Gross disc area: 8,490 sq. ft.
- Gross wing area: 584 sq. ft.
- Sweepback: Nil.
- Internal cabin dimensions:
- Length (ex. flight deck): 47 ft. 9 in.
- Max. width: 115 in.
- Max. height: 84 in.
- Max. usable floor area (ex. flight deck): 425 sq. ft.
- Max. usable volume (ex. flight deck): 3,000 cu. ft.

Accommodation
- Normal tourist: 57 (5 abreast).
- Max. coach: 75 (5 abreast).
- Volume of freight and baggage holds: Nil.

Powerplants
- Two Rolls-Royce Tyne with auxiliary compressors.
- Take-off power each (I.S.A., s.l.): Approx. 5,250 h.p.
- Four Fairey pressure jet units at rotor tips.
- De Havilland four-blade propeller 14 ft. 6 in. diameter.

Weights and Loadings
- Basic operational: 35,564 lb.
- Total fuel: 10,000 lb.
- Mfrs. max. payload: 16,000 lb.
- Max. take-off: 53,500 lb.
- Max. landing: 53,500 lb.
- Disc loading (max. t.-o. wt.): 6.3 lb./sq. ft.
- Wing loading (max. t.-o. wt.): 91.6 lb./sq. ft.
- Power loading (max. t.-o. wt.): Approx. 5.1 lb./h.p.

Performance
- Recommended cont. cruising speed (I.S.A.): 175 knots (at 5,000 ft. and 53,500 lb.).
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (1,240 Imp. gal.): 640 naut. mi. with 8,000 lb. payload at 175 knots (mean) at 5,000 ft. (mean).
- Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 75 naut. mi.

Structure: Torsion box wing structure, two spar, manufactured as one item. Fuel carried in bag tanks between spars. Fuselage approx. rectangular cross section—semi-monocoque. Rotor head and blades of steel construction. Designed for long service life.

Undercarriage: Tricycle configuration, twin wheels, main wheels retracting aft. Fully castoring nosewheel. Hydraulic brakes.

Flaps: None.

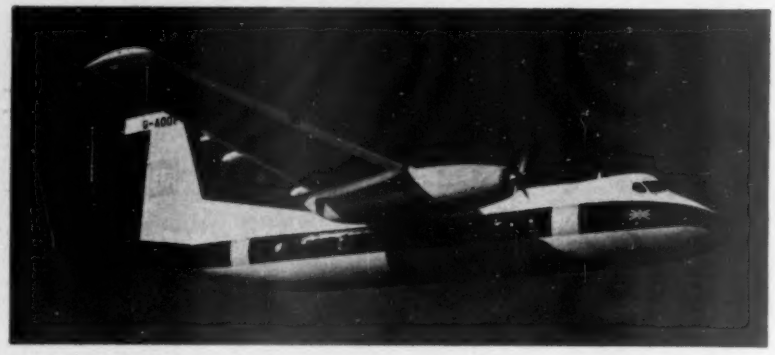
Air Brakes: None.

Flying Controls: Fully powered ailerons, elevators and rudders, from two independent hydraulic systems.

Systems: Independent 3,000 p.s.i. hydraulic systems. No. 1 system engine-driven, No. 2 system rotor-driven. Four 60 kVA. engine-driven alternators, for three phase 400 cycles 200V electrics, and 28V DC through rectifiers. Cyclic electric de-icing for airframe and rotor. Air conditioning and heating system provided. Pressure refuelling.

Commercial Aircraft . . . .

Short-haul turboprop feeder-liner, for service in 1960. First flown March, 1958. In production; three ordered.



The Handley Page Dart Herald

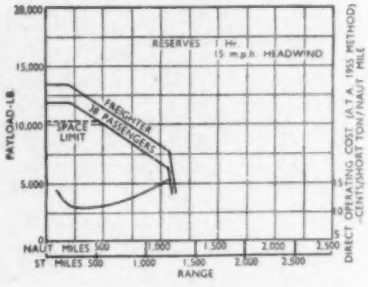
HANDLEY PAGE moved their sales campaign for the Dart Herald into high gear in April of this year when the second prototype left Britain on the first of a series of overseas sales tours. This first 18,500-mile tour took G-AODF through India, Ceylon, Pakistan, Persia, Turkey and Greece, and was followed by an even lengthier tour of South and Central America in July and August.

This same aircraft has now gone to New Zealand, for the opening next week of Wellington's new airport at Rongotai, and it will be joined later by the first of a batch of 10 production aircraft, G-APWA, which should fly later this month. The latter Dart Herald is to make demonstrations in Australasia and Asia before returning to Britain at the end of this year. Further tours in Africa and North America are planned for early 1960.

Developed wholly as a private venture, at a cost so far of something over £3 million, the Herald first flew with Dart engines on March 11, 1958. This particular prototype was lost in August, when the failure of the auxiliary gearbox breather layshaft in one of the engines led to an uncontrolled fire. This loss set the certification programme back several months, but full British certification to B.C.A.R. 1959 is expected in March, 1960.

While more than 300 hours of test flying (excluding the sales tours) have been accumulated, structure and fatigue testing have been giving very promising results. The fuselage already is approved by the A.R.B. for a safe service life of 30,000 flights, while tests in the water tank at Farnborough promise a safe life of 44,000 hours. A cyclic static test is to be applied to a production wing; experience with specimen tests to date suggest a crack-free life of 14,500 hours' flying over 150-mile sectors, or 32,000 hours over 500-mile sectors.

Production Heralds will be certificated at an initial gross weight of 39,000 lb., an increase of 2,000 lb. having recently been announced. On June 11, the Minister of Supply stated that the Government was to purchase three Dart Heralds (at a cost of some £750,000, including spares and crew training) which will be used for an initial five-year period by B.E.A. on certain Scottish routes where the aerodromes are too small for Viscounts. These will be delivered in the summer of 1960. A typical basic Herald price is £185,000.



Dimensions
Span: 94 ft. 9½ in.
Overall length: 71 ft. 11 in.
Overall height: 23 ft. 4 in.
Gross wing area: 886 sq. ft.
Sweepback: Nil.
Internal cabin dimensions:
Length (ex. flight deck): 48 ft. 9 in.
Max. width: 104 in.
Max. height: 77 in.
Max. usable floor area (ex. flight deck): 260 sq. ft.
Max. usable volume (ex. flight deck): 2,193 cu. ft.

Accommodation
Normal first-class: 38 (4 abreast).
Normal tourist: 42 (4 abreast).
Max. coach: 47 (4 abreast).
Volume of freight and baggage holds: Nil.

Powerplants
Two Rolls-Royce Dart 527 (R.Da.7).
Take-off power each (I.S.A., s.l.): 2,100 e.h.p. at 15,000 r.p.m.
Water injection system provided.
Rotol four-blade c.s., f.f. propellers, 12 ft. 6 in. diameter.

Weights and Loadings
Basic operational: 24,220 lb.
Total fuel: 8,640 lb.
Mfrs. max. payload: 13,300 lb.
Max. take-off: 39,000 lb.
Max. landing: 38,500 lb.
Max. zero fuel: 36,000 lb.
Wing loading (max. t.-o. wt.): 43.9 lb./sq. ft.
Wing loading (max. landing wt.): 43.3 lb./sq. ft.
Power loading (max. t.-o. wt.): 9.3 lb./e.h.p.

Design Criteria
Design limit speeds: Vc=206k. E.A.S. Vne=240k. E.A.S. Vd=267 k. E.A.S.

Performance
Recommended cont. cruising speed (I.S.A.): 237 knots (at 20,000 ft. and 36,500 lb.); consumption: 184 Imp. gal./hr.; power (per engine): 14,000 r.p.m.
Approach speed (at max. landing wt.): 90 knots.
Balanced field lengths (SR 422A, at max. t.-o. wt.):
At. I.S.A. at sea level: 4,100 ft.
At. I.S.A. +15°C at sea level: 4,700 ft.
At. I.S.A. at 5,000 ft.: 5,700 ft. at 36,850 lb.
Landing distance (SR 422A, 60% factor, max. landing wt.): 3,540 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (1,080 Imp. gal.): 1,500 naut. mi. with 6,140 lb. payload (38-seater) at 266 knots (mean) at 23,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max. (38-seat) payload 750 naut. mi.

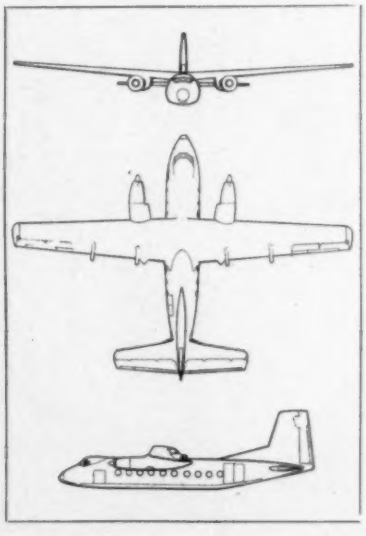
Structure: Three-spar wing centre section and two-spar outer wings with detachable tips. Stressed-skin fuselage. Extensive use made of spot-welding and sandwich construction technique throughout airframe.

Undercarriage: Two-wheel nose and main units. Steerable nose unit.

Flaps: Large-span Fowler type.

Flying Controls: Rod-, cable- and chain-operated. Spring-tabbed ailerons and rudder, geared tab on elevator.

Systems: Undercarriage retraction, flap operation, braking, nosewheel steering and self-centring by 3,000 p.s.i. hydraulic system supplied by two engine-driven pumps. Electrical supply from two 28-V. 6-kW DC generators, one on each engine. Four 24-V. batteries for starting, general and emergency use. Cabin air at 3.35 p.s.i. supplied by two engine-driven blowers. De-icing of wing, fin and tailplane leading edges by hot air ducted from engine exhaust heat-exchanger. Liquid system de-icing for windscreen. Fuel supplied from four 175-gal. bag tanks in centre section and two 200-gal. integral tanks one in each outer wing.



Delaney Gallay

INSULATED DUCTING

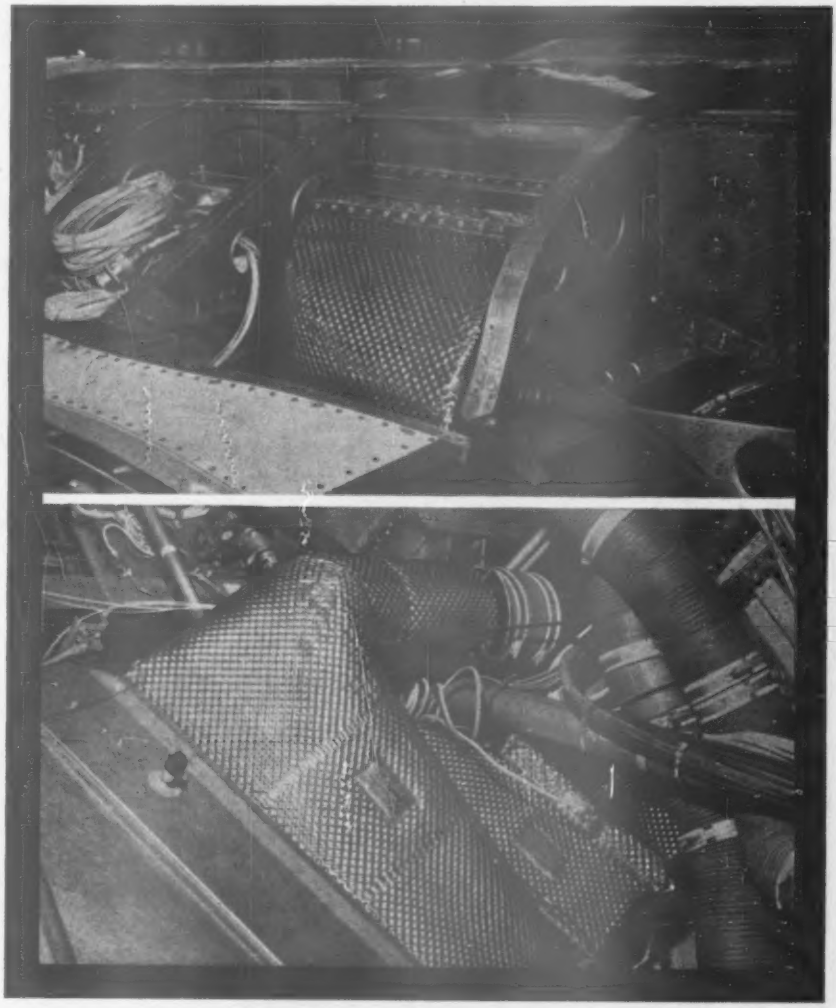
High efficiency—low weight

This is an adaptation of our normal thermal blankets to the situation where ducting is required to serve not only its normal purpose but at the same time to protect other components from excessive heat. Its great advantage is, of course, that it provides high thermal efficiency at a low weight.

Delaney Gallay ducting is constructed in exactly the same manner as Delaney Gallay thermal insulation blankets, except that the insulant is sandwiched between dimpled .004" stainless steel sheet on the outside and plain .015" sheet on the inside.

It can be shaped to fit any installation, complex shapes presenting no problems, and the units will retain their form during the lifetime of the components to which they are fitted.

If you have a problem that high efficiency / low weight ducting could solve, please write for full information to—



Ducting fitted to the inlet and outlet ports of the heat exchanger on the Handley Page Herald.

Delaney Gallay LTD

Specialists in heat exchange and heat insulation for over 40 years

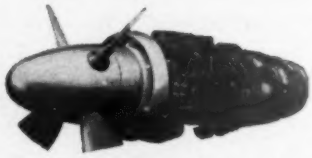
Vulcan Works, Edgware Road,
London, N.W.2
Telephone : GLAdstone 2201

CANADAIR CONVAIR 540

LOOKS FORWARD 10 AIRLINE YEARS

WITH ELAND JET-PROPS

The Eland-engined Canadair 540, latest version of the world-famous Convair, offers airline operators an aircraft that will meet their requirements and growth for at least the next ten years. It ensures them a better payload, a faster block speed and lower operating cost, combined with high performance, strong passenger appeal and ease and economy of maintenance.



The Eland has high aerodynamic efficiency; low specific weight; low specific fuel consumption; single lever control; automatic temperature compensation.

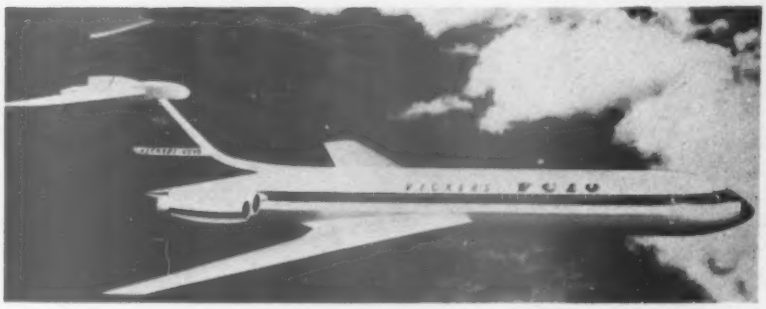
NAPIER ELAND JET-PROPS

D. NAPIER & SON LIMITED, LONDON, W.3. A MEMBER OF THE ENGLISH ELECTRIC AVIATION GROUP

Commercial Aircraft . . .

The Vickers V.C.10

Long-haul turbojet trunk-liner for service in 1963. *First flight* 1961. *In production;* 35 *ordered*



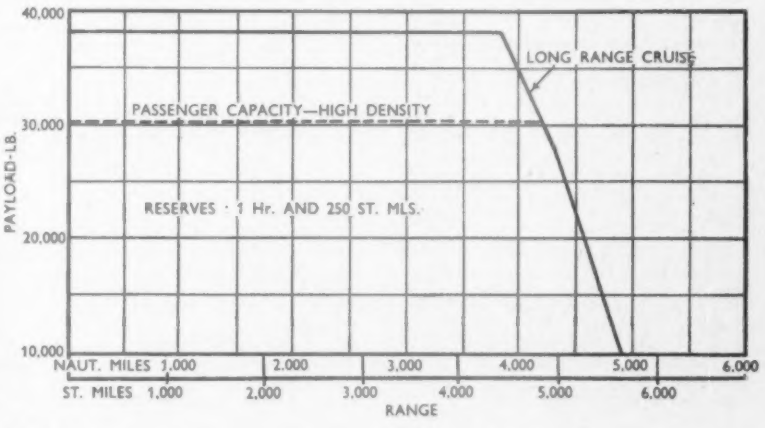
DETAILED weight and performance data for the V.C.10 appear on this page for the first time and give a good indication of the particular bracket occupied by Britain's largest current civil project. Whilst the payload-range performance compares with that of the later models of America's first-generation turbojet transports, the field performance is notably superior. This bestows on the V.C.10 a much greater flexibility of operation than can be achieved by any of the existing types—and correspondingly better economics.

The good field performance—which was selected by Vickers as one of the primary design aims—is achieved by making maximum use of leading-edge slats and trailing-edge flaps on a wing designed to combine high lift at low speeds with low drag at high speed. By using the developed Rolls-Royce Conway, the power loading at take-off is kept to a low value without undue penalty in the cruising régime; the very low s.f.c. of the Conways is reflected in the fuel capacity, which is smaller than that of other comparable long-range turbojet transports. The mark of Conways at present intended is the R.Co.42, which has a planned guaranteed thrust of 20,250 lb. and is thus the most powerful engine at present scheduled for civil use.

B.O.A.C.'s intention to order 35 V.C.10s for their African, Far Eastern and Australian services was announced in May, 1957. The contract (with an option on 20 more) valued at about £60 million without spares, was signed on January 14, 1958, when it was stated that there would be "sufficient structural strength and power to make it as good an Atlantic aeroplane as any." The V.C.10 thus promises to be the first "all-purpose" aeroplane for B.O.A.C., capable of operating the Corporation's routes in both hemispheres.

Over 2,000 hours of wind-tunnel testing on the V.C.10 have been completed so far, using over 30 large- and small-scale models. A full-size wooden fuselage mock-up has been built at Weybridge, with other portions at Hurn. Preliminary cockpit and cabin layouts have been investigated and the first jigs have been erected. One of the first major components completed will be a specimen wing section.

First flight of the V.C.10 is planned for the second half of 1961, with deliveries to B.O.A.C. starting in 1963.



Dimensions
Span: 140 ft. 0 in.
Overall length: 158 ft. 10 in.
Overall height: 39 ft. 1¼ in.
Gross wing area: 2,800 sq. ft.
Sweepback: 32.5° on 25% chord.
Internal cabin dimensions:
Length (saloon): 91 ft. 4 in.
Max. width: 138.2 in.
Max. height: 90 in.

Accommodation
Typical first-class: 88 (5 abreast).
Typical tourist: 126 (6 abreast).
High density: 150 (6 abreast).
Volume of freight and baggage holds: 1,350 cu. ft. (2).

Powerplants
Four Rolls-Royce Conway 540 (R.Co.42).
Take-off power each (I.S.A., s.l.): 20,250 lb.s.t.
Silencers all engines; thrust reversers two inners.

Weights and loadings
Basic operational: 138,500 lb.
Total fuel: 138,400 lb.
Mfrs. max. payload: 38,000 lb.
Max. take-off: 299,000 lb.
Max. landing: 197,500 lb.
Max. zero fuel: 176,500 lb.
Wing loading (max. t.-o. wt.): 106.9 lb./sq. ft.
Wing loading (max. landing wt.): 70.5 lb./sq. ft.
Power loading (max. t.-o. wt.): 3.7 lb./lb. thrust.

Design Criteria
Design limit speed: Mc/Vc=0.88/350 k.

Performance
Recommended cont. cruising speed (I.S.A.): 480–510 knots (at 30,000–40,000 ft. and 240,000 lb.); power (per engine): 9,300 r.p.m.
Approach speed (at max. landing wt.): 121 knots E.A.S.
Balanced field lengths (at max. t.-o.wt.):
At I.S.A. at sea level: 7,400 ft.
At I.S.A. +15°C. at sea level: 8,650 ft.
At I.S.A. at 5,000 ft.: 9,500 ft.
Landing distance (60% factor, max. landing wt.): 6,400 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (17,250 Imp. gal.): 5,200 naut. mi. with 22,500 lb. payload at 460 knots (mean) at 39,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A. with max. payload 4,560 naut. mi.

Structure: Torsion box wing built in five sections. Four shear webs with integrally machined upper and lower skin-stringer panels. Centre section structure built into lower half of fuselage. Torsion box provides tip-to-tip integral tankage.

Undercarriage: Four-wheel main bogies, inwards retracting twin-wheel steerable nose-wheel forward retracting. All units designed for free-fall.

Flaps and Slats: Fowler-type flaps, five sections per side. Full span leading edge slats.

Air Brakes: Three spoilers above each wing.

Flying Controls: Fully powered control system. Maximum safety ensured by sectionalized control surfaces with individual power units actuating each section and operated by duplicated independent control systems. Artificial feel units. Tailplane incidence hydraulically powered. Autopilot control includes tailplane trim.

Systems: Two independent hydraulic systems (3,000 p.s.i.) operate undercarriage, wheel brakes, nose wheel steering, wing slats and flaps, spoilers and tail plane. Emergency ram air turbo-pump. Electrical system supplied by four constant speed engine-driven AC alternators. Emergency ram air turbo alternator. De-icing by hot air for wing, empennage and powerplant. Cabin pressure up to 9 p.s.i. supplied by four engine-driven compressors. Air conditioning includes Freon systems and humidification.

Commercial Aircraft . . . .

The Vickers Vanguard

Medium-haul turboprop trunk-liner for service in 1960. First flown January, 1959. In production ; 40 ordered.

WITH three aircraft flying, Vickers are on target with the Vanguard flight-test programme. Since the first Vanguard flew on January 20, the programme has never been more than 10 hours behind schedule, and the total hours early this month were 406, in 262 flights. Serviceability has been outstandingly good.

The tests to date have mostly been investigating performance and aircraft systems. The flight-resonance investigation was completed in 30 hours on 17 flights in 24 days, in the course of which a true air speed of 530 m.p.h. (Mach 0.74) at 18,000 ft. was reached. Three- and two-engined landings have been made, and the aircraft has been flown down to 74 knots I.A.S. in the power-on stall with 40° flap at max. landing weight. The maximum test take-off weight to date has been 144,000 lb.

From now on, most of the test flying will be concerned with collecting certification and operational data, to achieve a full British C. of A. in March, 1960, by which time the total hours flown will be 1,500. Later this month the third Vanguard, G-APEB, is to leave for Khartoum, and will then go on to Johannesburg, in November, for high-altitude and high-temperature trials. Two more Vanguards will fly this year and six for B.E.A. will have flown by February, 1960. These will be followed by the 20 for T.C.A. starting in February, and then in 1961 by 14 more for B.E.A.

First Vanguards delivered to B.E.A. will be Type 951s with 4,985 e.h.p. Tyne 506 (R.Ty.1) engines and 135,000 lb. gross weight. The Type 952 for T.C.A. has 5,545 e.h.p. Tyne 512s (R.Ty.11) and 141,000 lb. gross weight, while the Type 953 for B.E.A. has this higher weight, a 29,000 lb. payload and the Tyne 506 engines.

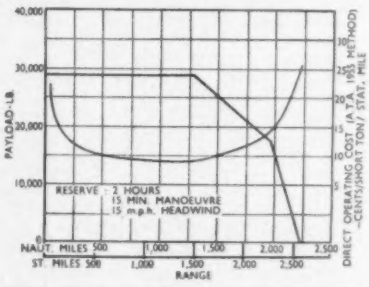
Vickers have also proposed Vanguard freighters, either as a direct modification of the Vanguard II with a 40,000-lb. payload; with structural provision for a gross weight of 166,000 lb. and a 64,000-lb. payload; or with clam-shell rear loading doors and a 62,000-lb. payload.

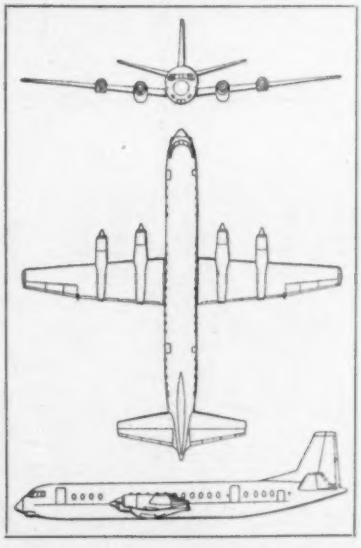
The Vanguard will be the first Tyne-powered aircraft in service. Backing up the aircraft test programme, Rolls-Royce are flying a Lincoln and an Ambassador as Tyne test-beds, and B.E.A. crews are using another Tyne-Ambassador for intensive flying trials, averaging 17 hours a day. Total Tyne hours in the air is now about 1,500.

Order Summary

(with dates of first delivery)

B.E.A., 6 Type 951, March, 1960, and 14 Type 953, 1961; T.C.A., 20 Type 952, July, 1960.





Dimensions
- Span: 118 ft. 0 in.
- Overall length: 122 ft. 10½ in.
- Overall height: 34 ft. 11 in.
- Gross wing area: 1,529 sq. ft.
- Sweepback: Nil.
- Internal cabin dimensions:
  - Length (ex. flight deck): 90 ft. 0 in.
  - Max. width: 128.7 in.
  - Max. height: 82.5 in.
  - Max. usable floor area (ex. flight deck): 893 sq. ft.
  - Max. usable volume (ex. flight deck): 5,690 cu. ft.

Accommodation
- Typical first-class: 76 (4 abreast).
- Typical tourist: 110 (5 abreast).
- Max. economy: 139 (6 abreast).
- Volume of freight and baggage holds: 1,360 cu. ft. (2).

Powerplants
- Four Rolls-Royce Tyne 512 (R.Ty.11.)
- Take-off power each (I.S.A., s.l.): 5,545 e.h.p. at 15,250 r.p.m.
- de Havilland four-blade reversing propellers, 14 ft. 6 in. diameter.

Weights and Loadings
- Basic operational: 83,500 lb.
- Total fuel: 40,800 lb.
- Mfrs. max. payload: 29,000 lb.
- Max. take-off: 141,000 lb.
- Max. landing: 121,000 lb.
- Max. zero fuel: 112,500 lb.
- Wing loading (max. t.-o. wt.): 92.2 lb./sq. ft.
- Wing loading (max. landing wt.): 79.2 lb./sq. ft.
- Power loading (max. t.-o. wt.): 6.37 lb./e.h.p.

Design Limit Speeds
- V_c=314 k. E.A.S. Vne=348 k. E.A.S.
- Vd=387 k. E.A.S.

Performance
- Recommended cont. cruising speed (I.S.A.): 367 knots (at 20,000 ft. and 121,000 lb.); consumption: 710 Imp. gal./hr.; engine speed: 13,500 r.p.m.
- Approach speed (at max. landing wt.): 127 knots.
- Balanced field lengths (at max. t.-o. wt.): At I.S.A. at sea level: 6,000 ft. At I.S.A. +15°C. at sea level: 7,250 ft. At I.S.A. at 5,000 ft.: 8,250 ft.
- Landing distance required (max. landing wt.): 5,850 ft.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (5,100 Imp. gal.): 3,000 naut. mi. with 17,500 lb. payload at 350 knots (mean) at 30,000 ft. (mean).
- Range (take-off to landing) still air, no reserves, I.S.A., with max. payload 2,200 naut. mi.

Structure: Torsion-box wing. Three shear webs with integrally machined upper and lower skin-stringer panels. Centre-section structure built into lower half of double-bubble fuselage. Torsion-box provides integral tankage, tips and centre section excluded.

Undercarriage: Twin-wheeled tricycle. Steerable nose-wheel. All forward-retracting and designed for free fall.

Flaps: Constant-chord Fowler-type, four sections per side.

Flying Controls: Manually operated through push-pull rods with aerodynamic balance and spring tabs.

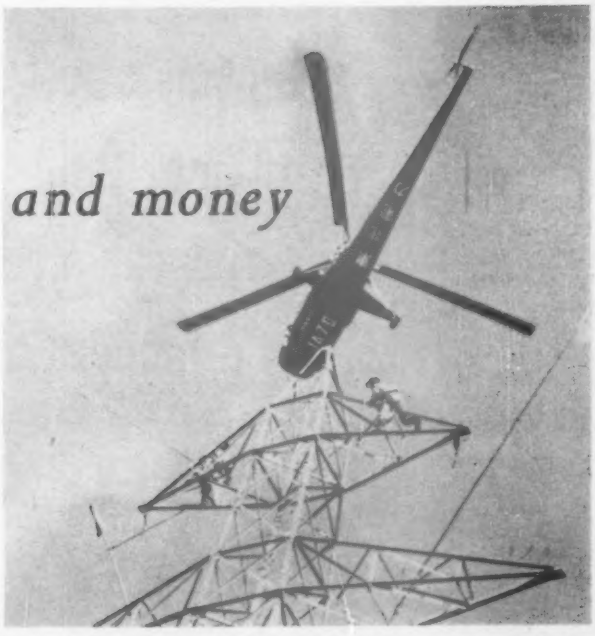
Systems: Duplicated hydraulic system (3,000 p.s.i.) operates undercarriage, flaps, wheel-brakes, nose-wheel steering, propeller brakes and airsteps. Electrical supply from four variable-frequency alternators providing AC power for de-icing propellers, cowls and spinners; remainder provides 28-v.DC via four transformer/rectifier units. Additional alternators on numbers one and four powerplants provide power for tail unit and windscreen de-icing. Wing de-icing by engine heat exchangers. Cabin air, at 6.5 p.s.i., supplied by blowers on inboard powerplants.

Every hour every day

the WIDGEON

saves

someone's time



and money

WESTLAND

WIDGEON

one of a wide range of proven Helicopters manufactured by

WESTLAND AIRCRAFT LIMITED YEOVIL ENGLAND

EUROPE'S LARGEST AND MOST EXPERIENCED HELICOPTER PRODUCERS

Marconi in the Comet 4

Equipped by Marconi to meet the major radio requirements of a modern airliner

MARCONI

COMPLETE AIRCRAFT AND AIRPORT RADIO SYSTEMS

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, CHELMSFORD, ESSEX, ENGLAND
M.2A

Commercial Aircraft . . . .

The Vickers Viscount

Short-medium-haul turboprop feeder- and trunk-liner, in service since April, 1953. Series production ending; 407 ordered.

AT the beginning of September Vickers had sold a total of 407 Viscounts to 54 operators (including 42 airlines) in 33 countries—only the Douglas DC-3 has seen comparable World-wide service as a transport aeroplane. Of the 407 sold, the 400th Viscount (illustrated) was handed over to Hunting-Clan on May 29 this year, and deliveries are now on the point of completion.

A dozen or so Viscounts are still in the "pipe-line" at Weybridge and can be completed rapidly as soon as orders are placed—several orders and re-orders are being negotiated. Once these aircraft are sold there will necessarily be a delay of 20 months or so for any future customers wanting Viscounts, although Vickers intend to keep lines open for both the 700 and 800 series for as long as practicable. Current basic prices, fully equipped, ex-works, are $1,120,000 for the 700D and $1,428,000 for the 810.

The majority of Viscounts sold have been in the 700 Series—a total of 284. This was the initial production type and has been offered with Dart R.Da.3s and, later, R.Da.6s. The performance has steadily improved since the first airline service was flown on April 18, 1953, and the latest specification for the Viscount 700D appears on this page. Also on offer is the Viscount 790, embodying special features for U.S. local service operators, including the ability to fly short sectors without intermediate refuelling, and wide-bladed propellers for best take-off performance. With integral airstairs at the forward door, layouts for up to 65 passengers have been planned—comparable to Marshalls' 63-seat high-density modification of the Viscount 701 for B.E.A.

Vickers have sold 66 Viscounts of the 800 Series, which have Dart R.Da.6s and a longer fuselage, and 57 of the 810 Series, which introduce the more powerful R.Da.7 engines. A specification of the latter variant appears on this page, at the latest certificated gross weight. The Viscount 806s for B.E.A. are, in a sense, hybrids, having the intermediate Dart 520s, and the Viscount 833s for Hunting-Clan are also unique in having Dart 530s, which develop the R.Da.7's full 2,105 e.h.p. for take-off, whereas the Dart 525s in other Viscount 810s are derated to 1,990 e.h.p. for take-off.

A further increase in take-off power is projected in the Viscount 840, which is the 810 Series re-engined with Dart 541 (R.Da.11) engines. Data for this variant are also tabulated on this page. The Viscount 840 will have block speeds between 10 and 20 m.p.h. higher than the 810, with comparable block fuels in I.S.A. conditions. Because of higher maintenance and overhaul costs and increased first costs associated with the more powerful engines, direct operating costs will be some 4% higher at ranges below 400 statute miles, and 2% higher at 1,000 miles.

The Rolls-Royce Dart, which began life at 1,400 s.h.p. in 1951, has completed a 150-hour Type Test at 2,660 e.h.p., has run a 25-hour test at 3,200 s.h.p. and is

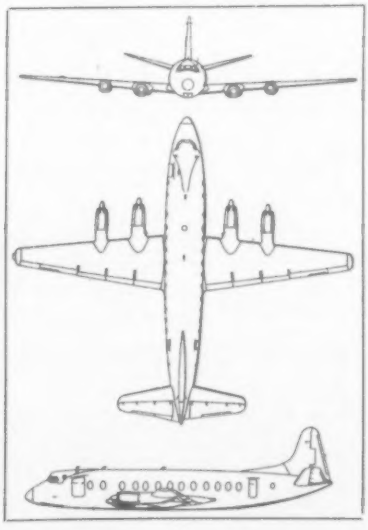
Structure: Single-spar wing, with two subsidiary spanwise members to complete torsion box. Built up in five spanwise sections. Semi-monocoque fuselage with large equi-stress elliptical window cut-outs.

Undercarriage: Twin-wheel tricycle with steerable nose-wheel.

Flaps: Double-slotted forward-retracting type, in six sections, electrically operated.

Flying Controls: Manually operated by push-pull rods.

Systems: Duplicated hydraulic system, at 2,000–2,500 p.s.i., operates undercarriage, nose-wheel steering and wheel-brakes. Electrical supply from four 9 kW generators. Cabin air, at 6.5 p.s.i., supplied from three engine-driven blowers and cooled by turbo-expander and air-cycle refrigeration. De-icing of wing and tail surfaces by hot air from engine heat-exchangers; electrical propeller and intake de-icing.



	700D	810	840
Dimensions :			
Wing span, ft. in.	93 8½	93 8½	93 8½
Overall length, ft. in.	81 10	85 8	85 8
Overall height, ft. in.	26 9	26 9	26 9
Gross wing area, sq. ft.	963	963	963
Sweepback	Nil	Nil	Nil
Internal cabin dimensions, ex. flight deck: length, ft. in.	45 0	54 0	54 0
Max. width, in.	119	117*	117*
Max. height, in.	78	78*	78*
Max. usable floor area, sq. ft.	430	520	520
Max. usable volume, cu. ft.	2,230	2,680	2,680
Volume of baggage and freight holds, cu. ft.	358 (2)	370 (2)	370 (2)
Accommodation :			
Normal first class	44	52–56	52–56
Normal tourist	53	65	65
Max. coach	63	75	75
Powerplants :			
Type and number	4 Dart 510	4 Dart 525	4 Dart 541
Rated t.-o. power (i.s.a., s.l.), e.h.p./r.p.m.	1,740/14,500	1,990/15,000	2,350/15,000
Propeller type and diameter, ft. in.	Rotol, 10 0	Rotol, 10 0	Rotol, 10 0
Weights and loadings :			
Basic operational weight, lb.	38,358	43,000	43,800
Total fuel, lb.	15,736	15,200	15,200
Mfrs. max. payload, lb.	11,800	14,500	13,700
Max. take-off, lb.	64,500	72,500	72,500
Max. landing, lb.	57,500	62,000	62,000
Max. zero fuel, lb.	50,168	57,500	57,500
Wing loading, max. t.-o. wt., lb./sq. ft.	67.0	75.4	75.4
Wing loading, max. landing wt., lb./sq. ft.	59.7	64.4	64.4
Power loading, max. t.-o. wt., lb./e.h.p.	9.26	9.11	7.71
Design limit speeds :			
Vc, knots E.A.S. at 10,000 ft.	235	264	264
Vne, knots E.A.S. at 10,000 ft.	266	294	294
Vd, knots E.A.S. at 10,000 ft.	296	325	325
Performance :			
Recommended cont. cruising speed, knots	269	310	341
At altitude, ft./weight, lb.	20,000/57,500	20,000/58,000	20,000/62,000
With consumption, Imp. gal. hr./r.p.m.	320/13,800	380/14,200	450/14,200
Approach speed (1.3 Vso), knots, max. land. wt.	115	119	119
Balanced field length (max. t.-o. wt.):			
I.S.A. at s.l., ft.	5,290	5,990	5,550
I.S.A.+15°C. at s.l., ft.	5,850	6,480	6,260
I.S.A. at 5,000 ft., ft.	7,200	7,950	7,500
Landing distance required, max. weight, ft.	3,970	4,270	4,270
Range with max. fuel, t.-o. to landing, no reserves :			
Still air, I.S.A., naut. miles	1,740	1,530	1,610
With payload, lb./fuel, Imp. gal.	10,680/1,967	14,300/1,900	13,500/1,900
At mean speed, knots/altitude, ft.	269/21,000	290/24,000	319/28,000
Range with max. payload, naut. miles	1,550	1,500	1,580

* Inside trim lines.

Commercial Aircraft . . . .

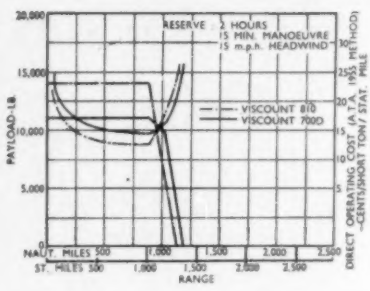
planned to reach a take-off power of 4,000 s.h.p. This is more power than the Viscount is ever likely to need, but indicates that the engine has plenty in hand should special requirements for high-altitude or high-temperature operation arise. The R.Da.6 now has an inter-overhaul period of 2,300 hr., and the R.Da.7, 1,200 hr. More than 300,000 hr. are added each month to the total of more than 8 million Dart hours flown in airline service.

Order Summary

This listing summarizes Viscount users at September 1, 1959; operators who have disposed of their Viscounts are not included. Totals do not include aircraft sold to other operators, but do include any aircraft written-off after acceptance. Dates are for delivery completion.

Viscount 700 Series: Aer Lingus, 4 (707), April, 1954; Air France, 12 (708), Aug., 1954; Airwork, 2 (736), Nov., 1957; Alitalia-L.A.I., 10 (785), May, 1958; Ansett-A.N.A., 2 (747), Sept., 1956; Austrian Airlines, 4 (779), March, 1958; Brazilian Govt., 2 (742, 789), Dec., 1957; B.E.A., 27 (701), July, 1956; B.W.I.A., 1 (702), 4 (772), Jan., 1958; Canadian Govt., 2 (737, 797), March, 1958; Capital Airlines, 60 (745), June, 1958; C.A.A., 5 (748), July, 1956; Cubana, 3 (755), June, 1956; Hunting-Clan, 1 (732), July, 1955; Icelandair, 2 (759), Dec., 1956; Indian Air Force, 2 (723, 730), Jan., 1956; Indian Airlines, 10 (768), June, 1958; Iranian Airways, 3 (782), May, 1958; Iraqi Airways, 3 (735), 1 (773), Nov., 1957; Kuwait Airways, 3 (702), 1 (754), 1958; Kuwait Oil Co., 1 (776), Oct., 1958; L.A.V., 3 (749), March, 1956; Malayan Airways, 2 (760), 1959; Mr. and Mrs. H. May, 1 (786), 1959; Middle East Airlines, 7 (754), Jan., 1958; Misrair, 6 (739), 2 (732), July, 1959; Northeast Airlines, 10 (798), Feb., 1959; Pakistan Govt., 1 (734), April, 1956; Philippine Air Lines, 2 (784), Sept., 1957; PLUNA, 3 (769), May, 1958; Royal Bank of Canada, 1 (793), April, 1959; South African Govt., 1 (781), June, 1958; Standard Oil Co., 1 (765), Feb., 1957; TACA, 3 (763, 786), April, 1959; T.A.A., 7 (720), 7 (756), July, 1958; T.C.A., 15 (724), 36 (757), May, 1959; Turkish Airlines, 5 (794), Dec., 1958; Union of Burma Airways, 3 (761), Oct., 1957; U.S. Steel Corp., 3 (764), Dec., 1956.

Viscount 800/810 Series: Aer Lingus, 6 (808), March, 1959; Airwork, 2 (831), March, 1959; Ansett-A.N.A., 4 (832), May, 1959; B.E.A., 24 (802), Sept., 1957, 19 (806),



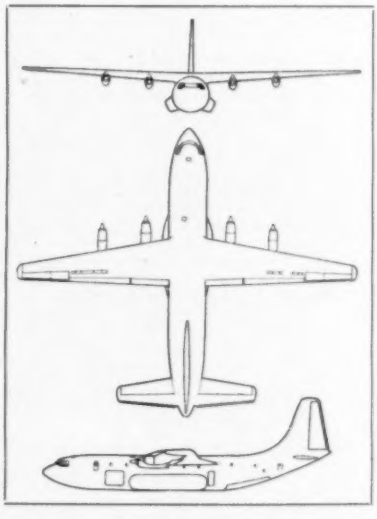
April, 1959; Cubana, 3 (818), Aug., 1959; Continental Air Lines, 15 (812), April, 1959; Eagle (Bermuda), 1 (805), March, 1958; Hunting-Clan, 3 (833), July, 1959; K.L.M., 9 (803), Dec., 1957; Lufthansa, 9 (814), April, 1959; Maritime Central Airways, 1 (805), 1959; N.Z.N.A.C., 3 (807), March, 1959; Pakistan International, 5 (815), 1959; S.A.A., 7 (813), Jan., 1959; Sudan Airways, 1 (831), June, 1959; Tennessee Gas Transmission Co., 1 (818), 1959; Transair, 3 (804), April, 1958; T.A.A., 2 (816), June, 1959; V.A.S.P., 5 (827), Jan., 1959.

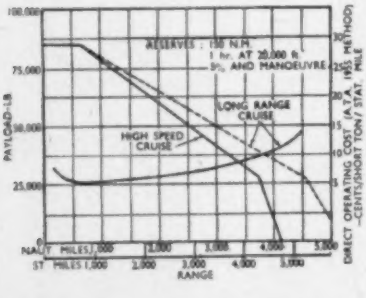
The Short Britannic

Short-to-long-haul turboprop freighter for service in 1965. First flight 1962. Ten ordered for military use.

ALTHOUGH the Britannic has been ordered in the first place as a strategic freighter for the R.A.F., most of the project designing was done with the civil market in mind, and Shorts offer the Britannic for commercial use from 1965 onwards. Based, in the first instance, on the Bristol Britannia wing, the Britannic is now a completely original design, being developed in the Series 3A version for which a specification is given here. The Britannic 1 and 2 were smaller versions, grossing 180,000 lb. with a 60,000-lb. payload and powered by the Proteus engine. The first Tyne project was the 195,000-lb. Britannic 3 with a 75,000-lb. payload. Production of a small batch of military Britannics is in hand for a first flight in 1962 and service in 1964.

Carrying a 50,000-lb. payload over a 2,500-mile sector, the Britannic is estimated to have total operating costs (direct and indirect) of the order of 18d. per ton/mile, or about half the current European air-freight rate. Over similar or shorter stages, ultra-low seat-mile costs could be achieved by the Britannic carrying 255 passengers in a high-density configuration.





Dimensions
- Span: 158 ft. 9½ in.
- Overall length: 136 ft. 5 in.
- Overall height: 47 ft. 0 in.
- Gross wing area: 2,466 sq. ft.
- Sweepback: 7° at 25% chord.
- Internal cabin dimensions:
  - Length (ex. flight deck): 84 ft. 6 in.
  - Max. width: 193 in.
  - Max. height: 165 in.
  - Max. usable floor area (ex. flight deck): 1,014 sq. ft.
  - Max. usable volume (ex. flight deck): 10,000 cu. ft. approx.

Accommodation
- Normal first-class: 195 (6 abreast).
- Normal tourist: 222 (6 abreast).
- Max. coach: 255 (6 abreast).
- Volume of freight and baggage holds: Nil.

Powerplants
- Four Rolls-Royce Tyne R.Ty.12.
- Take-off power each (I.S.A., s.l.): 5,730 e.h.p. at 15,250 r.p.m.
- de Havilland four-blade c.s., f.f., 16 ft. diameter propellers.

Weights and Loadings
- Basic operational: 111,000 lb.
- Total fuel: 81,200 lb.
- Mfrs. max. payload: 85,000 lb.
- Max. take-off: 218,000 lb.
- Max. landing: 205,000 lb.
- Max. zero fuel: 196,000 lb.
- Wing loading (max. t.-o. wt.): 88.5 lb./sq. ft.
- Wing loading (max. landing wt.): 83.0 lb./sq. ft.
- Power loading (max. t.-o. wt.): 9.5 lb./e.h.p.

Design Criteria
- Design limits: V_C=240 k. E.A.S. Vd=300 k. E.A.S.

Performance
- Recommended cont. cruising speed (I.S.A.): 320 knots (at 20,000 ft. and 180,000 lb.); consumption: 688 Imp. gal./hr.; power (per engine): max. cont. cruise (13,500 r.p.m.).
- Approach speed (at max. landing wt.): 127 knots.
- Balanced field lengths (SR422B, at max. t.-o. wt.):
  - At I.S.A. at sea level: 6,950 ft.
  - At I.S.A. +15°C. at sea level: 7,500 ft.
  - At I.S.A. at 5,000 ft.: 9,000 ft.
- Landing field length required (SR422B, max. landing wt.): 6,700 ft.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (10,150 Imp. gal.): 5,550 naut. mi. with 25,800 lb. payload at 304 knots (mean) at 28,000 ft. (mean).
- Range (take-off to landing), still air, no reserves, I.S.A. with max. payload 1,300 naut. mi.

The Canadair CL-44D

Long-haul turboprop freighter and cargo-convertible, for service in 1961. First flight November, 1959. In production; 25 ordered.

EXPECTED to make its first flight next month, the CL-44 is an expression of Canadair's determination "to become a leader in the air cargo aircraft business." The design springs from an R.C.A.F. requirement for a long-range freight and personnel utility transport and is based on the Britannia by an agreement with the Bristol Aeroplane Co. in April, 1957. Ten examples have been ordered by the R.C.A.F., with the designation CC-106; these are known to the makers as CL-44-6s, and have side-doors for freight loading.

Orders for the CL-44 placed last May by the Flying Tiger Line and Seaboard and Western, the two leading U.S. all-freight operators, were significant not only as the first for the commercial version of the CL-44, but also because they were the first ever placed by an airline for modern freight aircraft. Subject of these orders, valued at about $70 million, is the CL-44D-4, which has a swing-tail for straight-in rear loading of items up to 85 ft. by 11 ft. by 6 ft. 9 in. in size.

Sub-variants of this type are designated CL-44D-4-1, the all-cargo version for Seaboard and Western; CL-44D-4-2, all-cargo for Flying Tiger; and CL-44D-4-3, convertible cargo-passenger for Flying Tiger. These are intended for international operation and, in the tabulated data on this page, are indicated as "International cargo" and "Convertible" respectively.

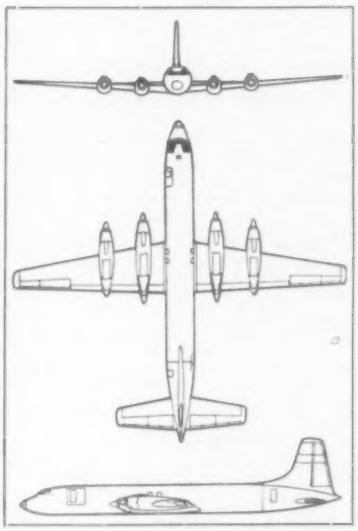
Canadair now offer, also, a pure cargo carrier for U.S. and Canadian domestic operation, the CL-44D-5 ("Domestic cargo" in the tables). This has the structure strengthened to allow 10,000 lb. increases in landing and zero fuel weights, which, together with a reduction in fuel capacity by deleting the centre section bag tanks, make a 13,000 lb. increase in payload possible.

Related to development of the Tyne engine, Canadair foresee growth of the CL-44 by 1963 to have a gross weight of 228,000-234,000 lb., and payloads of over 100,000 lb., in the CL-44E version. Direct operating costs in the region of 2½ cents/ton mile are forecast.

ORDER SUMMARY

(With dates of first deliveries)

R.C.A.F., 10 CL-44-6 (CC-106), November 1959; Seaboard and Western, 5 (+5) CL-44D-4-1, January, 1961; Flying Tiger Line, 10 (+5) CL-44D-4-2 and -3, early 1961.



Structure: Torsion-box wing structure with spars at 15% and 50% chord, and stiffened stress-carrying upper and lower skins; wing in two main units joined at fuselage centre-line. Integral wing tanks and one bag tank in centre section. Circular section semi-monocoque fuselage. Primary materials, 75ST alloy, with 24ST alloy for fuselage and wing lower-surface skins.

Undercarriage: Four-wheel bogie main units, backwards retracting, and steerable twin-wheel nose-wheel. Hydraulic brakes.

Flaps: Double slotted in one portion on each wing.

Air Brakes: None.

Flying Controls: Fully manual system, with servo operation by tabs on ailerons, elevators and rudder. Spring-loading in aileron and rudder circuits and hydraulic artificial feel system for elevator.

Systems: Main 3,000 p.s.i. hydraulic system for u/c, wheel brakes, nose-wheel steering and cargo-door operation, with emergency compressed-air system for u/c and brakes. Three engine-driven 40 kVA three-phase 400-cycle alternators generating at 115V., plus a variable frequency AC supply from three 60 kVA engine-driven generators and 28V. DC through rectifiers. Cabin pressurization at 8.33 p.s.i. max. by two engine-driven compressors. Wing de-icing by ram air passed over engine tail-pipes; tail unit de-icing by hot air from dual heater system; electric de-icing for intakes, propellers, windscreen and elevator horn balances. Pressure refuelling at 500 g.p.m.

Dimensions
- Span: 142 ft. 3 in.
- Overall length: 136 ft. 7 in.
- Overall height: 36 ft. 8 in.
- Gross wing area: 2,075 sq. ft.
- Sweepback: 7° at 25% chord.
- Internal cabin dimensions:
  - Length (ex. flight deck): 98 ft. 7 in.
  - Max. width: 138 in.
  - Max. height: 81 in.
  - Max. usable floor area (ex. flight deck): 1,080 sq. ft.
  - Max. usable volume (ex. flight deck): 6,380 cu. ft.

Accommodation
- Max. coach (iH. cvtbl.) 184
- Volume of freight and baggage holds: 1,011 cu. ft. (2)

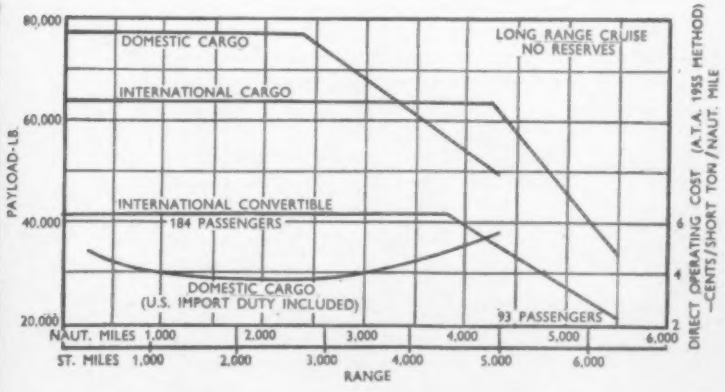
Powerplants
- Four Rolls-Royce Tyne 515/10.
- Take-off power each (I.S.A., s.l.): 5,730 e.h.p. at 15,250 r.p.m.
- De Havilland four-blade c.s., f.f. 16-ft. diameter propellers.

Weights and Loadings
- Basic operational: Dom. cargo, 88,215 lb.; Itl. cargo, 91,009; Cvtbl., 104,252 lb.
- Total fuel: Dom. cargo, 68,410 lb.; Itl., 81,200 lb.
- Mfrs. max. payload: Dom. cargo, 76,785 lb.; Itl. cargo, 63,991 lb.; Cvtbl., 40,470 lb.
- Max. take-off: 205,000 lb.
- Max. landing: Dom. cargo, 175,000 lb.; Itl., 165,000 lb.
- Max. zero fuel: Dom. cargo, 165,000 lb.; Itl., 155,000 lb.
- Wing loading (max. t.-o. wt.): 99.0 lb./sq. ft.
- Wing loading (max. landing wt.): Dom. cargo: 84.2 lb./sq. ft.; Itl., 79.5 lb./sq. ft.
- Power loading (max. t.-o. wt.): 8.95 lb./e.h.p.

Design Criteria
- Design limit speeds, E.A.S. (Cargo): Mc/Vc: 0.63/250 k. Mne/Vne: 0.63/278 k. Md/Vd: 0.70/312 k.
- Design limit speeds, E.A.S. (Cvtbl.): Mc/Vc: 0.63/275 k. Mne/Vne: 0.63/306 k. Md/Vd: 0.70/344 k.

Performance
- Recommended cont. cruising speed (I.S.A.) Dom. cargo: 337 knots (at 20,000 ft. and 175,000 lb.); Itl. cargo: 342 knots at 20,000 ft. at 165,000 lb.; Cvtbl.: 349 knots at 20,000 ft. at 150,000 lb.; consumption: 700 Imp. gal./hr.; power (per engine): 3,475 e.h.p.
- Approach speed (at max. landing wt.): 130 knots.
- Balanced field lengths (at max. t.-o. wt.): At I.S.A. at sea level: 7,660 ft. At I.S.A. +15°C at sea level: Dom. cargo, 9,800 ft.; Itl., 8,800 ft.* At I.S.A. at 5,000 ft.: Dom. cargo, 9,700 ft.*; Itl., 10,700 ft.*
- Landing distance (SR422A, max. landing wt.): Dom. cargo, 7,075 ft. Itl., 6,780 ft.
- Range, Domestic cargo (take-off to landing), still air, no reserves, I.S.A., max. fuel (8,520 Imp. gal.): 4,345 naut. mi. with 47,275 lb. payload at 319 knots (mean) at 25,000 ft. (mean).
- Range, International, (take-off to landing), still air, no reserves, I.S.A., max. fuel (10,150 Imp. gal.): 5,500 naut. mi. with 33,691 lb. (cargo) or 20,448 (passenger) payload at 325 knots (mean) at 25,000 ft. (mean).
- Range, Domestic, (take-off to landing) still air, no reserves, I.S.A., with max. payload: 2,385 naut. mi.
- Range, International, (take-off to landing) still air, no reserves, I.S.A. with max. payload: 3,220 naut. mi. (cargo) or 3,860 naut. mi. (passenger).

* Weight limited by second segment climb.



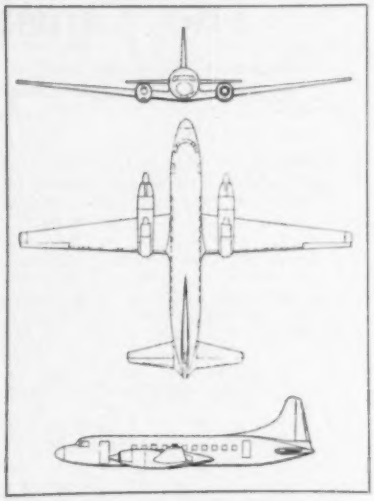
Commercial Aircraft . . . .

The Canadair 540

PRODUCTION of the Canadair 540 at Montreal results from the R.C.A.F.'s decision, in 1957, that its new medium transport must be turboprop-powered and built in Canada. As a member of the General Dynamics Corporation, Canadair was able to purchase the entire Convair 440 production line from fellow-member Convair and to put this aircraft into production with Eland turboprops.

The R.C.A.F. has ordered 10 of these aircraft with the designation CC-109. They are known to Canadair as the CL-66B, and have a large cargo door and strengthened freight floor. First delivery is scheduled for November, 1959.

The CL-66A or Canadair 540 is the commercial version for which data is given here, and the CL-66C is a conversion by Canadair of Convair 340s or 440s to Eland power. Three such conversions have been made, in addition to two earlier Napier/PacAero conversions used to obtain C.A.A. certification in August, 1958. One of the latter has been leased to Allegheny Airlines.



Dimensions
Span: 105 ft. 4 in.
Overall length: 79 ft. 2 in.
Overall length (with radome): 81 ft. 6 in.
Overall height: 28 ft. 2 in.
Gross wing area: 920 sq. ft.
Sweepback: 4.33° on 25% chord.
Internal cabin dimensions (ex. flight deck):
Length: 54 ft. 10 in.
Max. width: 107 in.
Max. height: 79 in.
Max. usable floor area: 396 sq. ft.
Max. usable volume: 2,515 cu. ft.

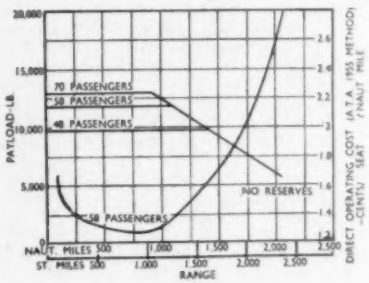
Accommodation
Normal first-class: 48 (4 abreast).
Normal tourist: 58 (4 abreast).
Max. coach: 70 (4 abreast).
Volume of freight holds: 402 cu. ft. (4).

Powerplants
Two Napier Eland 504A.
Take-off power each (I.S.A., s.l.): 3,500 e.h.p. at 12,500 r.p.m.
De Havilland four-blade c.s., f.f. 13 ft. 6 in. diameter propellers.

Weights and Loadings
Basic operational: 34,014 lb.
Total fuel: 13,614 lb.
Mfrs. max. payload: 12,986 lb.
Max. take-off: 53,200 lb.
Max. landing: 50,670 lb.
Max. zero fuel: 47,000 lb.
Wing loading (max. t.-o. wt.): 57.9 lb./sq. ft.
Wing loading (max. ldg. wt.): 55.1 lb./sq. ft.
Power loading (max. t.-o. wt.): 7.60 lb./e.h.p.

Design Limit Speeds
Mc/Vc=0.489/260 k. Mne/Vne=0.54/293 k.
Md/Vd=0.605/326k.

Performance
Recommended cont. cruising speed (I.S.A.): 279 knots (at 20,000 ft. and 48,000 lb.); consumption: 247 Imp. gal./hr.; power (per engine): 1,960 s.h.p.
Approach speed (at max. landing wt.): 100 knots.
Balanced field lengths (at max. t.-o. wt.): At I.S.A. at sea level: 4,550 ft.
At I.S.A. +15°C. at sea level: 5,300 ft.
At I.S.A. at 5,000 ft.: 6,150 ft.
Landing distance (SR422A max. landing wt.): 4,020 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (1,700 Imp. gal.): 1,800 naut. mi. with 5,572 lb.; payload at 279 knots (mean) at 20,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max. payload: 785 naut. mi. (1,055 naut. miles with 48 passengers).

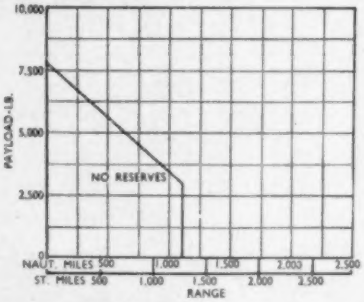


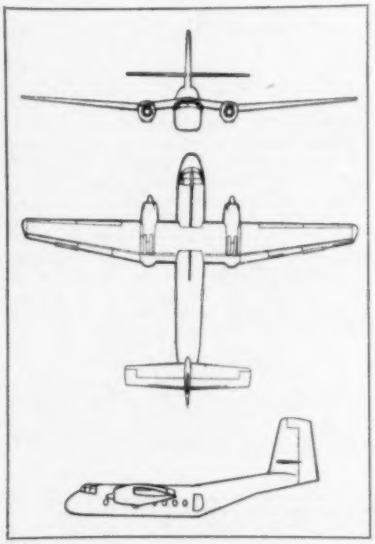
The de Havilland Caribou

SINCE the prototype Caribou made its first flight on July 30, 1958, at Downsview, it has undergone considerable development, resulting in an increase in gross weight and cabin volume without adverse effect on the STOL characteristics. The increase in gross weight from 24,000 lb. to 26,000 lb. was announced in April this year, and followed some 400 hr. flight testing with the first two aircraft. Accompanying the increase is a 45-in. stretch in the forward fuselage to increase the cabin volume to 1,150 cu. ft.

In addition to the two prototypes paid for by the Canadian Government, de Havilland is building five YAC-1As for the U.S. Army, the first three of which are scheduled for delivery this month. It is a condition of the U.S. Army contract that the Caribou is certificated to CAR 4B and the data given here is for the prospective civil version. The Canadian Army will test a Caribou (as the CC-108) and the U.S. Army has a requirement for up to 200.

A variant has been studied with two 1,920 e.h.p. turboprops, but, with present s.f.c., does not show much advantage. It may be offered later.





Dimensions
Span: 96 ft. 0 in.
Overall length: 72 ft. 7 in.
Overall height: 31 ft. 9 in.
Gross wing area: 912 sq. ft.
Sweepback: Nil.
Internal cabin dimensions:
Length (ex. flight deck): 28 ft. 9 in.
Max. width: 87 in.
Max. height: 75 in.
Max. usable floor area (ex. flight deck): 175 sq. ft.
Max. usable volume ex. flight deck): 1,150 cu. ft.

Accommodation
Normal tourist: 30 (3 abreast).
Max. coach: 40 (4 abreast).
Volume of freight and baggage holds: Nil.

Powerplants
Two Pratt & Whitney R-2000-7M2.
Take-off power each (I.S.A., s.l.): 1,450 h.p. at 2,700 r.p.m.
Hamilton Standard c.s., f.f., 3-blade propellers, 13 ft. 1 in. diameter.

Weights and Loadings
Basic operational: 18,260 lb.
Total fuel: 5,040 lb.
Mfrs. max. payload: 7,700 lb.
Max. take-off: 26,000 lb.
Max. landing: 26,000 lb.
Max. zero fuel: 26,000 lb.
Wing loading (max. t.-o. wt.): 28.5 lb./sq. ft.
Wing loading (max. landing wt.): 28.5 lb./sq. ft.
Power loading (max. t.-o. wt.): 8.97 lb./b.h.p.

Design Criteria
Design limits: V_C=182 k. Vne=219 k. Vd=243 k.

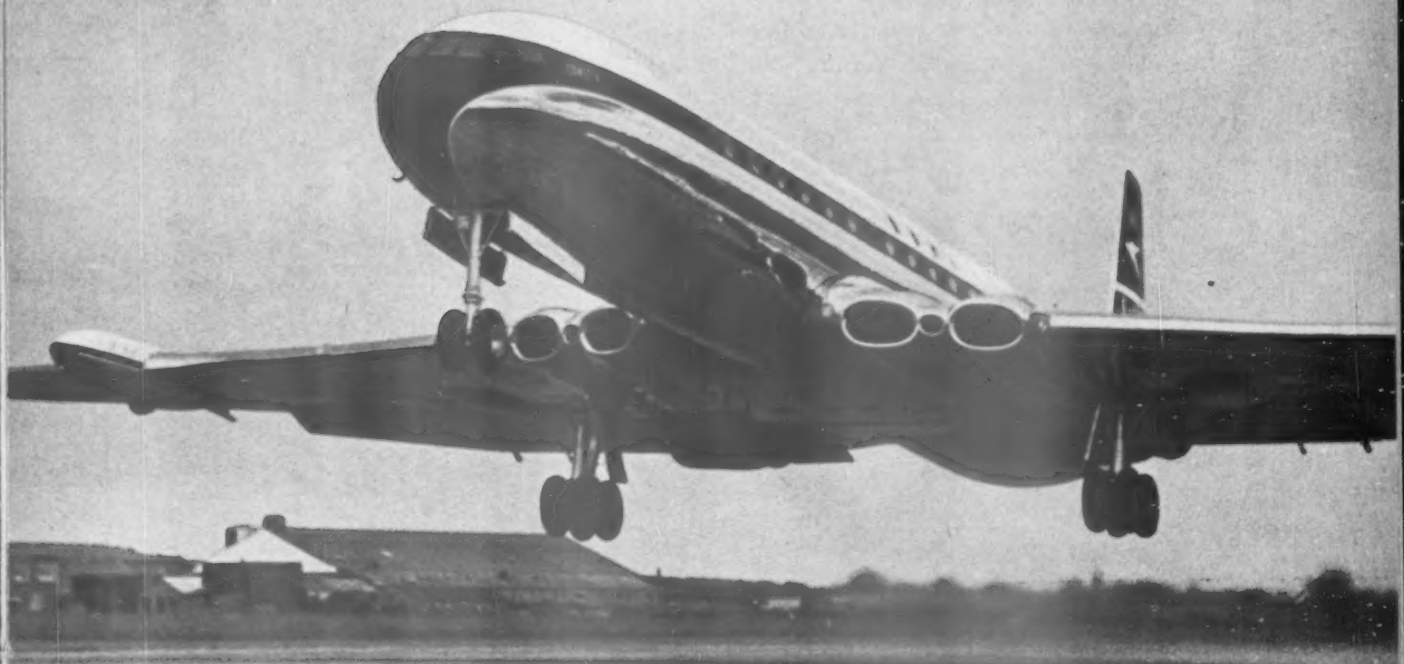
Performance
Recommended cont. cruising speed (I.S.A.): 158 knots (at 7,500 ft. and 26,000 lb.); consumption: 89 Imp. gal./hr.; power (per engine): 725 b.h.p.
Approach speed (at max. landing wt.): 72 knots.
Field lengths (V1=V2, max. t.-o. wt.): At I.S.A. at sea level: 2,640 ft.
At I.S.A. +15°C. at sea level: 2,940 ft.
At I.S.A. at 5,000 ft.: 3,670 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 1,540 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (700 Imp. gal.): 1,100 naut. mi. with 3,000 lb. payload at 158 knots (mean) at 7,500 ft. (mean).

The

COMET (D.H.106)

(Rolls-Royce Avon jet engines)

Acknowledged to be
the right airliner for profitable
operations on major continental
and intercontinental airways
of moderate traffic density, now
and in the years ahead



Some Comet Routes *Every Continent feels the impact of Comet passenger appeal, payability and versatility.*

FIRST JET SERVICE ACROSS THE NORTH ATLANTIC
FIRST JET SERVICE LONDON—TOKYO
FIRST JET SERVICE ACROSS THE SOUTH ATLANTIC
FIRST JET SERVICE IN LATIN AMERICA
FIRST JET SERVICE NORTH—SOUTH AMERICA
FIRST JET AIRLINER ACROSS THE PACIFIC
FIRST JET AIRLINER AROUND THE WORLD
FIRST JET AIRLINER

DE HAVILLAND

WEAVER

There are no bits in the beehive. No dust, no dirt. Before getting down to production the bees set about the complete elimination of impurities. As with bees, so with AIR BP. BP devotes much time and technical skill in laboratory and field to perfect fuel cleanliness. New equipment developed or adapted by BP engineers already achieves standards far higher than is demanded. Great strides have been made in micro-filtration and water-separation, to ensure the delivery of the cleanest fuel at the highest rate to aircraft on busy international air routes.

Clean sweep

AIR BP work on these lines continues, aiming at a clean sweep of the minutest contaminants in the service of aviation.

AIR BP

THE AVIATION SERVICE OF BRITISH PETROLEUM

Commercial Aircraft . . . .

Short-to-medium haul turbojet trunk-liner, in service since May, 1959. First flown May, 1955. In production, 51 ordered.

The Sud-Aviation Caravelle

CERTIFICATES of airworthiness were awarded to the Caravelle I by the French Ministry of Transport on April 2, 1959, and by the American F.A.A. on April 8. This concluded the first stage in the aircraft's development, which had begun in 1951 with an officially sponsored design contest. Sud-Aviation was declared the winner of this competition in July, 1953, and the first prototype of the Caravelle (with Avon R.A.26 engines) flew on May 27, 1955.

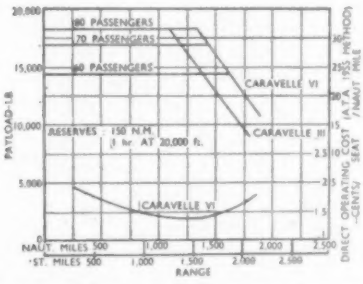
A second prototype flew on May 6, 1956, and the first production Caravelle (with Avon R.A.29/1s) flew on May 18, 1958. While these three aircraft were used for the flight-test and certification programme, two other complete specimens were allocated to static and water-tank fatigue testing. The fatigue tests began on January 5, 1959, and the initial series was completed on May 22, comprising 15,000 cycles of a programme representing a three-hour flight. The static testing to date has permitted an increase in gross weight to 45 tonnes (99,200 lb.).

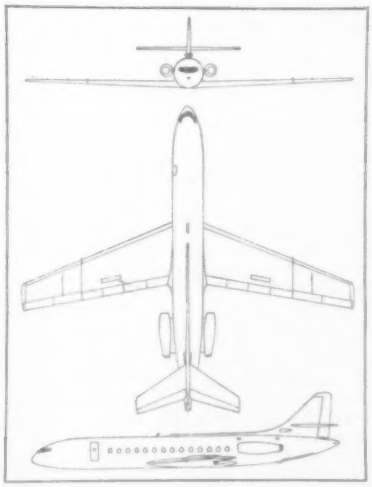
Air France took delivery of its first Caravelle on March 19, ahead of certification, followed by the second and third on April 2 and May 15. The first three for S.A.S.—with Norwegian, Swedish and Danish registrations respectively—were delivered on April 10, April 25 and May 5. Further deliveries have now been made to both airlines and by the end of the year Air France should have eight and S.A.S. seven Caravelles. The first for Varig was handed over on September 15, with a second due in December.

S.A.S. flew an inaugural service with the Caravelle on April 26, from Copenhagen to Beirut. Regular services were started by Air France on May 12 and by S.A.S. on May 15.

The aircraft at present in service are known as Caravelle Is, with 10,500-lb.s.t. Avon R.A.29/1s. The initial weight is 95,900 lb. but, as noted above, this can be increased to 99,200 lb. Next aircraft in the series, for delivery in 1960, will be Caravelle IIIs, with 11,400-lb.s.t. Avon R.A.29/3s and 99,200 lb. weight.

A further stage in development of the Avon—the R.A.29/6 with an extra compressor stage—will produce the Caravelle VI, with a weight of 103,600 lb. Sud-Aviation have also projected the Caravelle VII with 14,000-lb.s.t. Rolls-Royce R.B.141/3 turbofans and a weight of 110,230 lb. With a 3-ft. fuselage extension, this is the only Caravelle variant to incorporate any "physical" stretch.





Dimensions
Span: 112 ft. 6 in.
Overall length (I, III, VI): 105 ft. 0 in.
Overall length (VII): 108 ft. 0 in.
Overall height: 28 ft. 7 in.
Gross wing area: 1,579 sq. ft.
Sweepback: 20° at 25% chord
Internal cabin dimensions:
Length (ex. flight deck): 72 ft. 0 in.
Max. width: 118.5 in.
Max. height: 82 in.
Max. usable floor area (ex. flight deck): 646 sq. ft.
Max. usable volume (ex. flight deck): 4,200 cu. ft.

Accommodation
Normal first-class: 64 (4 abreast) (VII: 68)
Normal tourist: 80 (5 abreast) (VII: 85)
Volume of freight and baggage holds: 282 cu. ft. in two holds.

Structure: Torsion box wing structure with three spars forming integral fuel tanks, built in two pieces joined on fuselage centre line. Circular section monocoque fuselage.

Undercarriage: Four-wheel bogie main units retracting inwards into wing and fuselage, and twin-wheel steerable nose-wheel. Hydraulic brakes.

Flaps: Slotted flaps in four sections each side.

Air Brakes: Spoilers above and below each wing ahead of the flaps.

Flying Controls: Hydraulically-powered two-piece ailerons, rudder and elevator, with artificial feel.

Systems: Twin 2,500 p.s.i. hydraulic systems (each with electrically-powered standby) for flying-controls, u/c, wheel brakes, flaps, spoilers, nosewheel steering, passenger door and feel simulation. Two engine-driven 30V. DC generators, providing 28.5V. DC and 115V. 400 cycle AC through two inverters; 26V. AC also through a transformer. De-icing of wings, tail unit and intakes by engine compressor air. Cabin pressurization at 8.05 p.s.i., by engine-bleed air via two blowers. Two-point pressure refuelling.

Order Summary

(With dates of first deliveries)

Air France, 24, March, 1959; S.A.S., 17 (four for Swissair), April, 1959; Varig, 2, September, 1959; Air Algerie, 4, February, 1960; Finnair, 3, March, 1960; Royal Air Maroc, 1, May, 1960.

	Caravelle I	Caravelle III	Caravelle VI	Caravelle VII
Powerplants:				
Type and number	2 Avon 522	2 Avon 527	2 Avon 531	2 R.B.141/3
Rated t.-o. power (i.s.a. at s.l.), lb.s.t./r.p.m.	10,500/8,050	11,400/8,000	12,200/8,050	13,980/9,750
Weights and Loadings:				
Basic operational weight, lb.	58,600	57,970	59,223	62,170
Total fuel, lb.	33,000	33,000	33,000	33,500
Mfrs. max. payload, lb.	18,450	18,450	18,450	19,400
Max. take-off, lb.	95,900	99,208	103,600	110,230
Max. landing, lb.	91,338	94,468	98,650	104,985
Max. zero fuel, lb.	77,160	77,160	78,265	81,570
Wing loading, max. t.-o. wt., lb./sq. ft.	60.7	62.8	65.5	70.0
Wing loading, max. land. wt., lb./sq. ft.	57.8	59.6	62.5	66.2
Power loading, max. t.-o. wt., lb./lb.s.t.	4.56	4.35	4.24	3.96
Design limit speeds:				
Mc/Vc (knots E.A.S.)	0.77/300	0.77/300	0.77/320	0.77/330
Mne/Vne (knots E.A.S.)	0.81/325	0.81/325	0.81/345	0.80/355
Md	0.84	0.84	0.84	0.84
Performance:				
Recommended cont. cruising speed, kt.	396	418	430	442
At altitude, ft.	32,800	35,000	37,000	38,000
At weight, lb.	80,900	81,900	82,600	83,200
With consumption, Imp. gal./hr./power per engine, lb.s.t.	638/5,250	662/5,200	682/5,600	595/5,760
Approach speed (1.3 Vso) knots, max. land. wt.	114	115	115	116
Balanced field length (SR422A, max. wt.)				
I.S.A. at s.l., ft.	5,900	5,900	6,050	6,000
I.S.A. at 15°C. at s.l., ft.	6,750	6,750	6,800	6,650
I.S.A. at 5,000 ft., ft.	9,900	8,200	8,300	—
Landing distance required (SR422A), ft.	5,315	5,530	5,840	6,270
Range with max. fuel, still air, no reserves, I.S.A. naut. miles	2,380	2,300	2,300	2,380
With payload, lb./fuel, Imp. gal.	5,400/4,125	8,100/4,125	11,620/4,125	16,600/4,125
At mean speed, kt./alt., ft.	388/32,800	405/35,000	402/37,000	430/38,000
Range with max. payload, naut. miles	1,390	1,520	1,820	2,200

THE AEROPLANE
and ASTRONAUTICS

Commercial Aircraft . . . .

The Boeing 707

Medium and long haul turbojet trunk-liner, in service since October, 1958. First flown December, 1957. In production; 197 ordered.

BOEING AIRPLANE CO. received the C.A.A. Type Certificate for the first model of the 707 on September 23, 1958. Subject of the certificate—the first for a U.S.-built turbojet transport—was the 707-120 in Pan American configuration; with Pratt & Whitney JT-3C-6 engines it was cleared for operation at a weight of 248,000 lb.

Three aeroplanes were used in this certification programme, the first of which flew on December 20, 1957, and the second on February 3, 1959. At the time of certification, these three 707-120s, all for Pan American, had flown, respectively, 279¼, 218¼ and 202¼ hours, and the old "dash 80" prototype had flown 1,021¼ hours, for a grand total of 1,722 hours. A provisional certificate was awarded to the -120 on August 15, 1958, and, on the same day, Pan American accepted delivery of the first of their fleet of six. Before the end of the month the airline was flying experimental cargo services between New York and San Juan (Puerto Rico).

Regular passenger operations were started by Pan American on October 26, 1958, using the domestic model 707-120 on the long-haul North Atlantic operation under the pressure of B.O.A.C.'s Comet competition.

In the course of flight development trials, and before deliveries began, the Boeing 707 was modified to have leading-edge flaps. These flaps operate automatically when the trailing edge flaps reach a setting of 9° down. On the larger -320 and -420 models, two segments of leading-edge flap are used on each wing.

Following closely upon the 707-120 for Pan American was the domestic model for American Airlines. The first was delivered, with a provisional certificate, on October 23, 1958, and the full Type Approval was obtained in December.

American Airlines inaugurated U.S. transcontinental services on January 25, 1959, but, by leasing the spare capacity of the Pan American 707-120s in the off-peak winter season, National Airlines had already become the first U.S. domestic jet operator, on December 10, on the New York-Miami route.

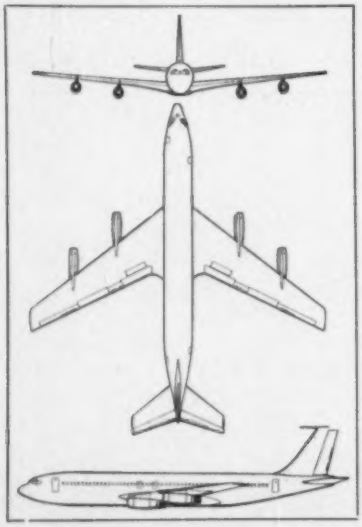
The early months of 707 operation were beset by teething troubles and other difficulties, most of which have now been overcome. One particular series of troubles was concerned with the undercarriage, which required a reduction in the automatic braking pressure and an increase in the hydraulic pressure in the snubber. Surging in the hydraulic system also gave some trouble; this has been overcome by fitting a new type of hydraulic pump or by modifying the system. Some of the more spectacular incidents involving 707s have been attributed to mishandling rather than airframe malfunctioning.

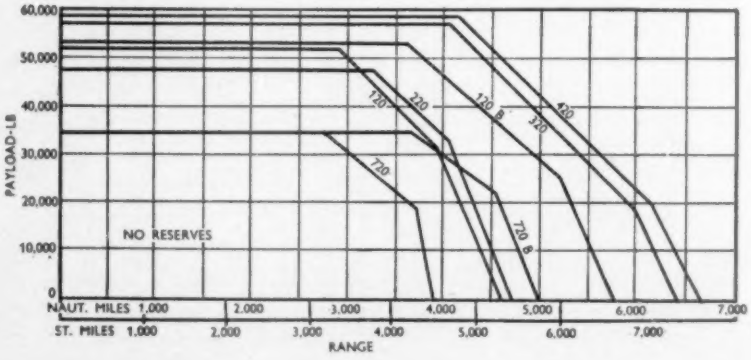
Closely related to the 707-120, the 707-220 made its first flight in June, 1959, by which time deliveries of -120s had been made to T.W.A., Continental, Qantas and the U.S.A.F. in addition to Pan American and American. The -220, deliveries of which are to begin this month, has been ordered only by Braniff International.

The first Intercontinental Boeing 707-320 made its first flight on January 11 and started C.A.A. certification trials on February 15, in which it was later joined by a second test aircraft—both in Pan American configuration. The F.A.A. awarded a Type Certificate to the 707-320 on July 15, by which time the two aircraft had totalled 401 hours, including 166 hours of F.A.A. testing. Deliveries to Pan American began on July 17, and this airline put the Intercontinental into service between the U.S. West Coast and Europe on August 26 and across the North Atlantic on October 10. T.W.A. will start using its 707-320s across the Atlantic on November 24.

The 707-320 was certificated with JT-4A-5 turbojets and at a weight of 302,000 lb., in accordance with SR422A. Further consideration of the take-off performance has recently led the F.A.A. to modify this certificate, however, to increase (at least temporarily) the V_R and V2 speeds. This has served to increase the balanced field length, or reduce the maximum permissible weight for a given runway length.

The present Intercontinental model, at 302,000 lb., is included in the table of data, right. Flights have been made at weights up to 315,000 lb., and last February Boeing announced further development of the design to an approved weight of 311,000 lb., with an associated increase in undercarriage strength. There will also be increased fuel capacity, from 17,650 Imp. gal. to 19,635 Imp. gal., and the absolute no-reserve range will be 6,025 naut. miles. This increased-weight





model is also likely to have the 17,000-lb. JT-4A-11 turbojets.

A similar increase in weight will be possible on the Conway-engined 707-420 when the later Conways become available. At present, flight testing and certification are based on a 302,000-lb. weight and 16,500-lb. Conway 505s. The first 707-420 for B.O.A.C. made its first flight on May 20, and certification will be completed in the near future. Highest projected weight for any member of the family is 316,000 lb. for the Boeing 735, a commercial freighter with JT3D turbofans, a swing-tail and a 98,000-lb. payload.

Smallest member of the 707 family is the 720-020 (sometimes also known as the 707-020, and originally the 717). Since first announced, this variant has been considerably developed to provide a medium-range transport cruising at higher speeds than the larger members of the family. The first 720 is due to be rolled out at the Renton factory in October and should be ready for delivery to United Airlines, with a Type Certificate, by next April.

To give the 707 its higher limiting Mach number, the t/c ratio of the inner wing has been effectively reduced by fitting a false leading edge between the fuselage and inner pod. Take-off and landing performance has been improved—to increase the aircraft's flexibility—by fitting leading-edge flaps on three sections on each wing. Lightweight versions of the JT3C engine are used. The 707 configuration has been tested on the "dash-80," which has achieved a speed equal to Mach 0.91 in level flight.

Taking advantage of the new family of turbofan engines are the "B" models of the Boeing family, the 120B and the 720B, details of which are listed below. The 720B is a re-engined 720, with higher weights made possible by the increased power. The 707-120B is similarly related to the 707-120, but, in order to make the most use of the new engines, will have the same wing as the 720.

The turbofan-powered Boeings should be ready for service in 1961, and Boeing will then inaugurate a programme of modifying existing 707-120s and 720s to the new standard for those airlines requiring the improved model. American Airlines has already indicated its intention of converting its whole Boeing fleet to turbofans.

At mid-September, 59 Boeing 707s had been delivered. Fifty-four in service had flown 960,000 passengers and had completed approximately 1,900 million passenger-miles in 56,500 hours.

Structure: Two-spar wing in two main units joined by a fuselage-width centre section. Integral wing tanks and bag tank in centre section. Double-bubble monocoque fuselage.

Undercarriage: Four-wheel bogie main units, inward retracting, and twin-wheel steerable nose-wheel. Hydraulic brakes.

Flaps: Double slotted in two portions on each wing. Four segments of leading-edge flaps.

Air Brakes: Two spoilers above and below each wing, and u/c up to 320 knots I.A.S.

Flying Controls: Aerodynamically balanced manual low-speed ailerons and separate high-speed ailerons with differential spoilers. Aerodynamically balanced manual rudder and elevators, with hydraulic rudder boost for large angles. Electrically v.i. tailplane.

Systems: Duplicated 3,000 p.s.i. hydraulic system for u/c, wheel brakes, flaps, spoilers, nose-wheel steering and windscreen wipers. Four 30 kVA three-phase alternators generating at 115V, with rectifiers for 28V DC requirements, and 36 amp.-hr. battery. Cabin pressurization 8.6 p.s.i. by three turbocompressors driven by engine compressed air. De-icing of wing and engine intakes by turbine-bled air; electric mats on tailplane; Nesa-glass windscreen. Two-point pressure refuelling at 1,500 g.p.m.

Order Summary

(With dates of first deliveries)

707-120: Pan American, 6, Aug. 15, 1958; American, 25, Oct. 23, 1958 (to be converted to -120B); Continental, 4, April 20, 1959; T.W.A. 15, Jan. 29, 1959; U.S.A.F., 3 (VC-137A), May 4, 1959; Qantas, 7, May, 1959; Cubana, 2, March, 1960.

707-220: Braniff, 5, Oct., 1959.

707-320: Pan American, 17, July, 1959; Air France, 17, Nov., 1959; Sabena, 5, Dec., 1959; T.W.A. 18, Sept., 1959 (six reported sold to Pan American); South African Airways, 3, July, 1960.

707-420: Lufthansa, 4, Jan., 1960; Air-India, 3, Jan., 1960; B.O.A.C., 15, Dec., 1959; Varig, 2, July, 1960.

720: American, 25, 1960 (ten as 720B, others to be converted); United Airlines, 18, April, 1960; Irish Air Lines, 3, Nov., 1960.

	707-120	707-120B	707-220	707-320	707-420	720	720B
Dimensions:							
Wing span, ft. in.	130 10	130 10	130 10	142 5	142 5	130 10	130 10
Overall length, ft. in.	144 6	144 6	144 6	152 11	152 11	136 4	136 4
Overall height, ft. in.	38 5	38 8	38 5	39 2	39 2	38 1	38 1
Gross wing area, sq. ft.	2,433	2,433	2,433	2,892	2,892	2,433	2,433
Sweepback, deg. at 25% chord	35°	35°	35°	35°	35°	35°	35°
Internal cabin dimensions, ex. flight deck:							
Length, ft. in.	104 10	104 10	104 10	111 6	111 6	94 0	94 0
Max. width, in.	139	139	139	139	139	139	139
Max. height, in.	90.9	90.9	90.9	90.9	90.9	90.9	90.9
Max. usable floor area, sq. ft.	1,092	1,092	1,092	1,164	1,164	1,003	1,003
Max. usable volume, cu. ft.	7,652	7,652	7,652	8,150	8,150	7,030	7,030
Volume of holds outside cabin, cu. ft.	1,600 (2)	1,600 (2)	1,600 (2)	1,700 (2)	1,700 (2)	1,340 (2)	1,340 (2)
Accommodation:							
Normal first class	121	121	121	131	131	110	110
Max. coach	179	179	179	189	189	149	149
Powerplant:							
Type and number	4 JT-3C-6	4 JT-3D-1	4 JT-4A-3	4 JT-4A-3	4 Conway 505	4 JT-3C-7	4 JT-3D-1
Rated take-off power (i.s.a. at s.l.) lb.s.t.	13,000 (wet)	17,000 (dry)	15,800 (dry)	15,800 (dry)	16,500 (dry)	12,000 (dry)	17,000 (dry)
Weights and Loadings:							
Basic operational weight, lb.	112,800	120,734	120,720	—	—	—	109,500
Total fuel, lb.	113,138	113,138	103,233	160,171	143,075	79,228	90,785
Mfr.'s max. payload, lb.	52,200	53,000	48,750	57,100	58,800	34,500	34,500
Max. take-off, lb.	247,000	258,000	247,000	302,000	302,000	202,000	221,000
Max. loading, lb.	175,000	185,000	175,000	198,000	198,000	175,000	175,000
Max. zero fuel, lb.	165,000	170,000	170,000	190,000	190,000	139,000	144,000
Wing loading, max. t.-o. wt., lb./sq. ft.	101.52	106.0	101.52	104.4	104.5	83.0	90.8
Wing loading, max. landing wt., lb./sq. ft.	71.93	76.2	71.93	68.6	68.6	71.9	71.9
Power loading, max. t.-o. wt., lb./lb.s.t.	4.75	3.8	3.91	4.77	4.6	4.21	3.25
Design limit speeds:							
Mc/Vc (knots E.A.S.)	.88 (360 k.)	.90 (360 k.)	.88 (360 k.)	.90 (360 k.)	.90 (360 k.)	.90 (360 k.)	.90 (360 k.)
Mne/Vne (knots C.A.S.)	.895 (383 k.)	.90 (383 k.)	.895 (383 k.)	.90 (383 k.)	.90 (383 k.)	.90 (383 k.)	.90 (383 k.)
Md/Vd (knots E.A.S.)	.95 (425 k.)	—	.95 (425 k.)	.94 (425 k.)	.94 (425 k.)	—	—
Performance:							
Cruising speed, long range to high speed cruise, knots	456–508	459–526	452–526	457–521	454–524	465–521	470–540
At altitude, ft.	40,000–25,000	40,000–25,000	40,000–25,000	40,000–25,000	40,000–25,000	40,000–25,000	40,000–25,000
At weight, lb.	200,000	210,000	200,000	190,000	190,000	180,000	200,000
With consumption, lb/hr.	16,300	21,950	22,400	26,300	21,800	16,800	22,500
Approach speed (1.3 Vso), knots	139	137	139	138	138	126	134
Balanced field lengths required (SR422B, at max. t.-o. wt.):							
I.S.A. at s.l., ft.	10,200*	8,600	6,700	9,700	10,650	7,400	6,400
I.S.A. +15°C. at s.l., ft.	10,750*	10,000	8,300	11,000	12,450	8,300	7,400
I.S.A. at 5,000 ft., ft.	—	12,000	9,250	12,000	13,600	9,800	8,400
Landing distance required (SR422B, at max. land. wt.), ft.	5,980*	5,980	6,350	6,450	6,600	5,750	5,750
Range with max. fuel, t.-o. to landing, no reserves:							
Still air, I.S.A., naut. mi.	3,260	5,200	4,050	5,980	6,130	3,700	4,550
With payload, lb.	43,850	24,700	3,350	17,930	19,630	18,270	20,600
At mean speed, knots/altitude, ft.	457/36,000	461/37,500	455/37,500	457/36,000	456/36,000	465/37,500	469/37,500
Range with max. payload, naut. mi.	2,895	3,570	3,250	4,070	4,150	2,760	3,650

* Demonstrated to SR422 requirements.

Commercial

Aircraft . . . .

The Convair 880 and 600

Medium-to-long-haul turbojet trunk-liner for 1959 delivery. First flown January, 1959. In production; 81 ordered.

FLIGHT testing of the Convair 880 began on January 27, 1959, and the second and third aeroplanes joined the test programme on March 31 and August 10 respectively. The second aircraft off the production line has been used for static testing since December, 1958, and is now being completely rebuilt for eventual delivery to a customer.

Apart from one major incident, flight testing has proceeded smoothly and Convair have been particularly pleased with performance of the CJ-805-3 engine, which is the first powerplant General Electric has ever developed for commercial use. The incident, which was widely publicized but actually held up the programme only a little, concerned the loss of a substantial portion of the fin and rudder when rudder flutter developed on the first aircraft. Wind-tunnel testing had indicated the likelihood of some trouble of this kind and flutter dampers were originally fitted to all primary control surfaces. Preliminary flight tests proving uneventful, these dampers were removed—but have been replaced since the incident described.

The first Convair 880, which completed 123 hours in 60 flights in the first five months of testing, is being used primarily for basic systems and performance flight-testing. In this, it is being assisted by No. 3 (i.e. the second to fly), which totalled 69 hours in 29 flights in the first three months. This was the first aircraft with thrust reversers and before joining in the general test programme was used to establish the final cascade configuration for these reversers; 91 taxi runs were made with 42 different cascade arrangements. By the beginning of August the first two aircraft had totalled 250 hours between them in 130 flights.

Aircraft No. 4, after completing acoustical and air-conditioning tests, is being fitted with complete interior furnishing. No. 5 is scheduled for delivery to T.W.A. in November, and No. 7 will be the first for Delta Air Lines, delivered in January. The actual F.A.A. testing was started last month, using the first three aeroplanes, and is aimed at achieving full certification by next spring. As part of the general test programme, a complete fuselage and stub wing started a water-tank fatigue test on June 23, for an initial 50,000 applications of the one-minute cycle.

All the test work to date has been concerned with the Model 22 version of the

(*Continued on page* 353)

	Model 22	Model 31	Model 30
Dimensions:			
Wing span, ft. in.	120 0	120 0	120 0
Overall length, ft. in.	129 4	129 4	139 5½
Overall height, ft. in.	36 0	36 0	39 6
Gross wing area, sq. ft.	2,000	2,000	2,250
Sweepback, deg. on 30% chord	35°	35°	35°
Internal cabin dimensions, ex. flight deck, length, ft. in.	89 4	89 4	98 10
Max. width, in.	128	128	128
Max. height, in.	85	85	85
Max. usable floor area, sq. ft.	930	930	1,050
Max. usable volume, cu. ft.	6,560	6,560	7,400
Volume of baggage and freight holds, cu. ft.	863 (2)	863 (2)	928 (2)
Accommodation:			
Normal first class	88	88	90+6
Normal tourist	110	110	118
Max. coach	120	120	134
Powerplants:			
Type and number	4 CJ-805-3	4 CJ-805-3	4 CJ-805-23
Rated t.-o. power (i.s.a. at s.l.) lb.s.t./r.p.m.	11,200/7,680	11,200/7,680	16,100/7,680
Weights and loadings:			
Basic operational weight, lb.	89,575	88,900	114,525
Total usable fuel, lb.	72,159	92,930	101,204†
Mfrs. max. payload, lb.	27,425	32,000	34,475
Max. take-off, lb.	184,500	203,400	239,200
Max. landing, lb.	132,800	155,000	180,000
Max. zero fuel, lb.	117,000	126,000	149,000
Wing loading, max. t.-o. wt., lb./sq. ft.	92.25	101.6	106.3
Wing loading, max. landing wt., lb./sq. ft.	66.4	77.5	80.0
Power loading, max. t.-o. wt., lb./lb.s.t.	4.12	4.54	3.72
Design limit speeds:			
Mc/Vc (Mach No./knots E.A.S.)	0.89/375	0.89/375-395	0.91/375-395
Performance:			
Best cost cruising speed, knots	484	535*	496
At altitude, ft./weight, lb.	35,000/150,000	20,000/150,000	35,000/175,000
With consumption, Imp. gal./hr.	1,290	2,540	1,280
Approach speed (1.3 Vso), knots/weight, lb.	127/122,225	120/155,000	120/150,445
Balanced field length (SR422B), max. t.-o. wt.			
I.S.A. at s.l., ft.	8,500§	9,800	8,950§
I.S.A.+15°C. at s.l., ft.	9,700	11,300	9,950
I.S.A. at 5,000 ft.	—	—	13,500
Landing distance (unfactored), max. landing wt., ft.	3,420	3,480	3,240
Range with max. fuel, t.-o. to landing, no reserves, still air, I.S.A., naut. miles	3,720	4,500	4,740
With payload, lb./fuel, Imp. gal	23,150/8,970	17,070/11,500	25,120/12,600
At mean speed, knots/altitude, ft.	450/35,000	453/35,000	496/35,000
Range with max. payload, naut. miles	3,430	3,600	4,200

* Maximum continuous; long range cruise at 450 k. at 35,000 ft. at 150,000 lb.; 1,060 gal./hr.
† Optional long-range total, 104,980 lb. § Four engined continuous t.o. without clearway.

Structure: Three-spar wing with built-up spars and roll-tapered skins. Integral fuel tanks in torsion-box. 2024-T4 alloy for bottom skin, 7075 for upper skin. Quasi-elliptical-section fuselage with heavy-gauge 2024 alloy skin. Fail-safe design.

Undercarriage: Four-wheel main bogies, inwards retracting. Twin-wheel steerable nose-wheel, forward retracting. Hydraulic brakes on main and nose gear.

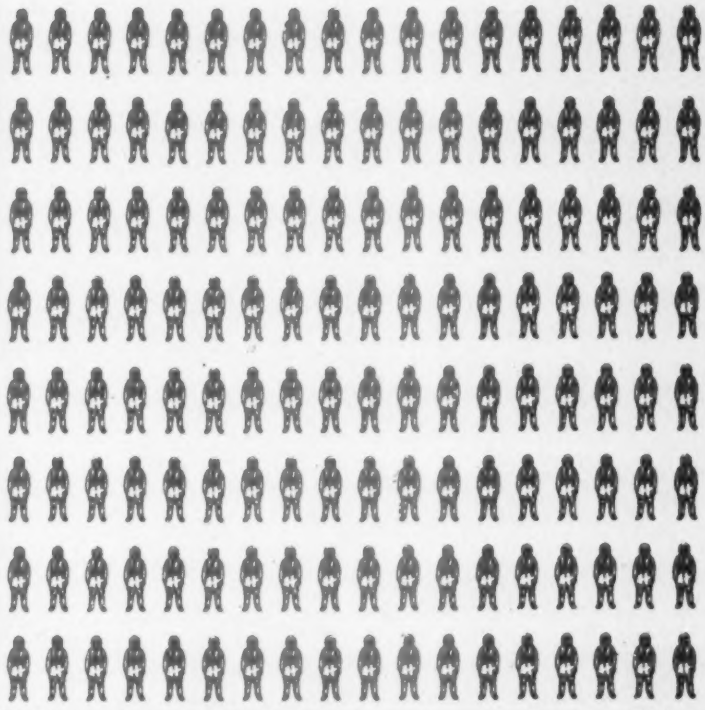
Flaps: Double-slotted Fowler-type in three pieces each side. Four-piece leading-edge flaps on each wing on Models 30 and 31, interconnected with flaps.

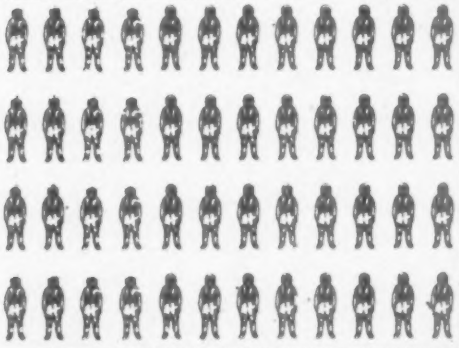
Air Brakes: Four upper-wing spoilers ahead of flaps, and u/c up to 375 knots I.A.S.

Flying Controls: Fully manual inboard ailerons with servo tabs, in conjunction with differentially operated inboard and outboard spoilers through Convair "mixing box." Manual rudder with "q-feel," and manual elevator with servo tabs; hydraulic v.i. tailplane. Hydraulic rudder boost on Model 30.

Systems: Dual 3,000 lb. hydraulic systems for flaps, u/c, spoilers, tailplane, brakes and nose-wheel steering; flaps and spoilers operable by either system. Four 40 kVA. engine-driven generators provide 115/208V. 400-cycle AC plus four rectifiers for 28V. DC; 28V. DC battery. Cabin pressurization at 8.2 p.s.i. from two turbo-compressors driven by engine compressed air. De-icing of wing and intakes by engine-bleed air; electric tail unit de-icing; Nesa-glass windscreen and air-blast rain removal. Four-point pressure refuelling at 1,000 gal./min.

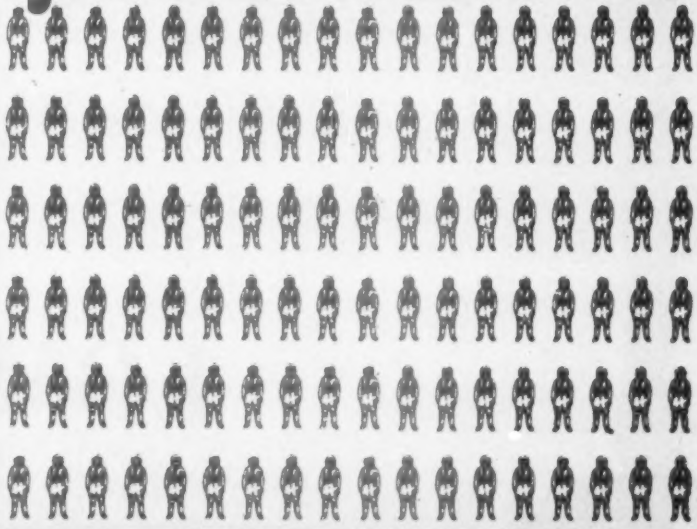
300 lives saved





by MARTIN-BAKER Ejection Seats

to date



MARTIN-BAKER AIRCRAFT CO., LTD.

LOMBANK SALUTE THE ACHIEVEMENTS

LOMBANK

LIMITED

CREDIT FINANCE FOR THE AVIATION INDUSTRY

OF BRITISH AIRCRAFT MANUFACTURERS

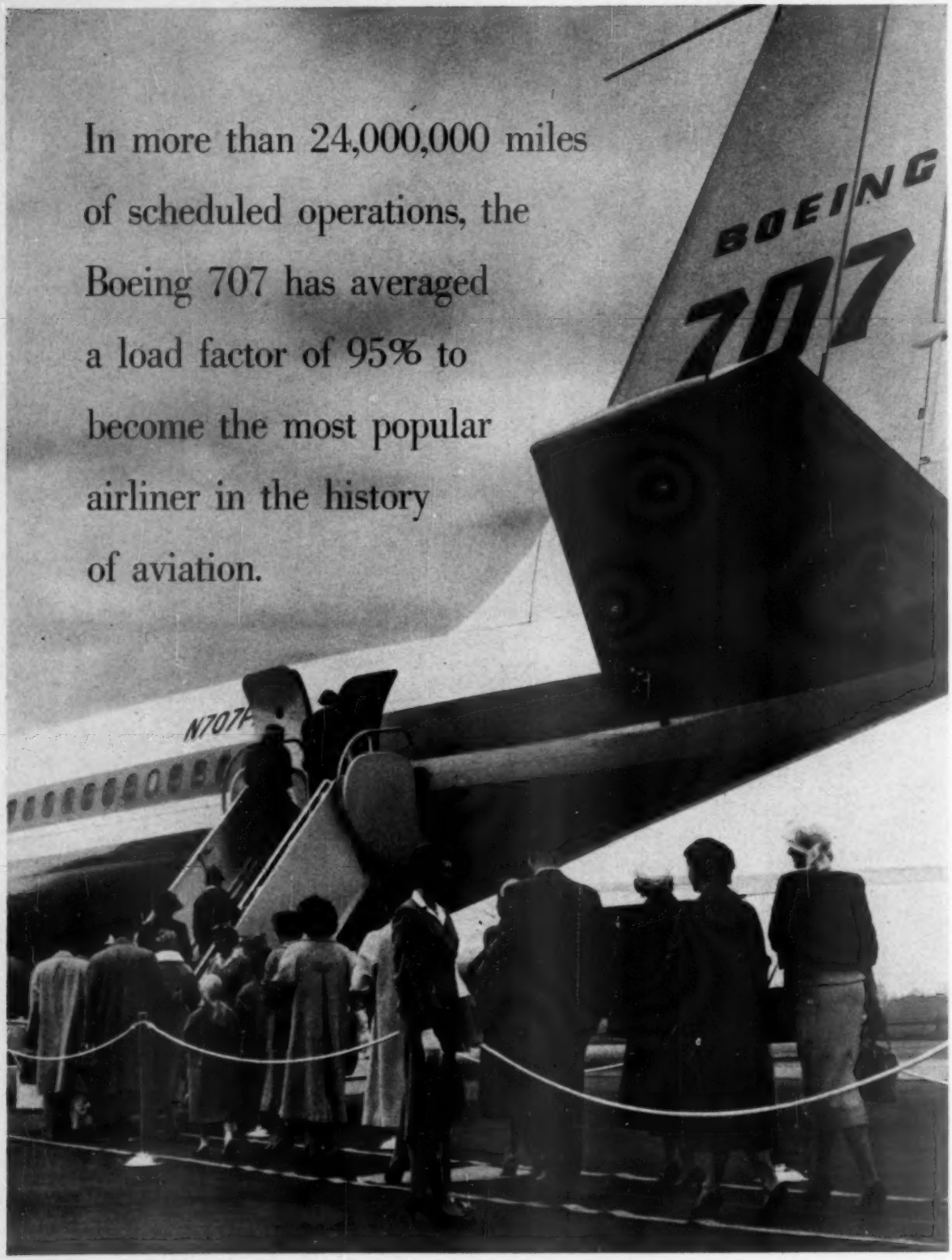
Head Office:

LOMBANK HOUSE,

LOMBANK CORNER, PURLEY WAY, CROYDON

THORNTON HEATH 6911 (30 LINES)

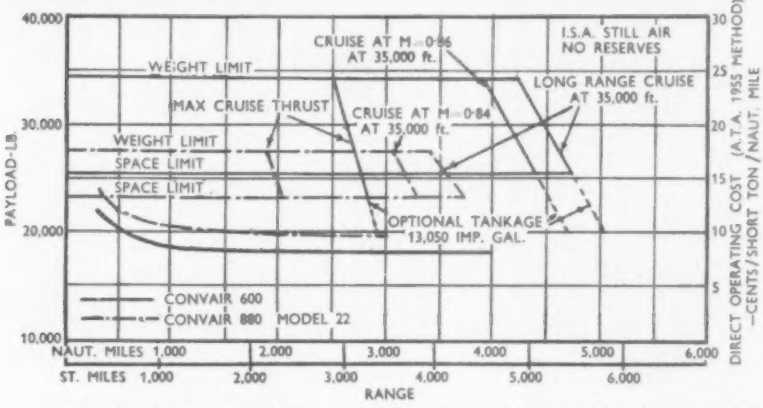
SUBSIDIARY OF LOMBARD BANKING LIMITED



These airlines have ordered Boeing 707 or shorter-range 720 jetliners: AIR FRANCE • AIR-INDIA • AMERICAN • B.O.A.C. • BRANIFF CONTINENTAL • CUBANA • IRISH • LUFTHANSA • PAN AMERICAN • QANTAS • SABENA • SOUTH AFRICAN • TWA • UNITED • VARIG • *Also* MATS

BOEING family of jetliners

Commercial Aircraft . . . .



(*Continued from page 352*)

Convair 880, which is the initial medium-range domestic version for T.W.A. and Delta. Details of the long-range Model 31 were first given last October, when the joint Swissair/S.A.S. order for five was announced, and although these two airlines have now ordered seven Convair 600s instead, work on the Model 31 is continuing for two South American customers—Transcontinental S.A. and REAL Aerovias—and for Civil Air Transport of Formosa.

Dimensionally the same as the Model 22, Model 31 has an extra 2,580 Imp. gallons of fuel in centre-section tanks, increased gross weight and payload and leading-edge flaps. It is therefore a straightforward "stretch" and can be regarded as the international model of the basic design. The first is due to fly in September, 1960, and will be available for service at Model 22 weights. Certification at full weight is scheduled for April, 1961.

A more extensive "stretch" led to the third member of the Convair family—the Model 30, or Convair 600, which was announced in July, 1958, when American Airlines ordered 25. The Convair 600 was designed around the extra power and better economy of the CJ-805 turbofan engine, and has a longer fuselage than the 880 variants.

Another distinctive feature is the use of anti-shock bodies, or "Whitcomb bumps," on the wings to delay the drag rise and permit a higher economic cruising speed. The wing chord of the Convair 600 has been increased, as has the area of the flaps, and leading-edge flaps are used. The first Convair 600 is scheduled to fly in September, 1960, with certification by May, 1961, using the first three aeroplanes.

Order Summary

(With dates of first deliveries)

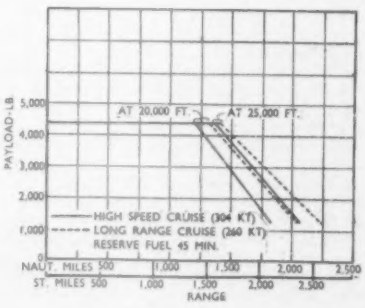
T.W.A., 30 Model 22, November, 1959; Delta Air Lines, 10 Model 22, December, 1959; Transcontinental S.A., 4 Model 31; REAL-Aerovias, 4 Model 31, December, 1960; C.A.T. (Formosa), 1 Model 31, November, 1960; Swissair/S.A.S., 7 Convair 600 (+6), 1961; American Airlines, 25 Convair 600 (+25), June, 1961.

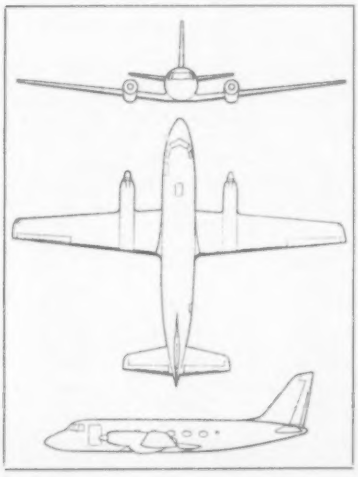
The Grumman Gulfstream

FIRST flight of the Gulfstream, on August 14, 1958, marked the company's return to commercial aircraft production. Designed for the executive market, the Gulfstream is "self-sufficient," capable of operating without any ground equipment from any 4,400-ft. field. It has capacity for a maximum of 20 passengers.

Before the Gulfstream flew, provisional orders had been placed for 27 aircraft, and quantity production was planned from the start. F.A.A. certification was obtained in May, 1959, in compliance with CAR 4b and SR-422A, two production prototypes having been used for the trials. The third Gulfstream is a company demonstrator and the fourth was delivered to the first customer in June, 1959. By September 1, 12 had been delivered of 40 then on order, and production is at the rate of three a month.

The Gulfstream is designed to have a structural fatigue life of 25 years and the structure is fail-safe. Basic price is $845,000, electronics, auto-pilot and customer-specified interior bringing the total up to the $1 million mark.





Dimensions
- Span: 78 ft. 6 in.
- Overall length: 63 ft. 9 in.
- Overall height: 22 ft. 9 in.
- Gross wing area: 610.3 sq. ft.
- Sweepback: Nil.
- Internal cabin dimensions:
  - Length (ex. flight deck): 33 ft. 0 in.
  - Max. width: 88 in.
  - Max. height: 73 in.
  - Max. usable floor area (ex. flight deck): 177 sq. ft.
  - Max. usable volume (ex. flight deck): 1,200 cu. ft.

Accommodation
- Normal executive: 10–12 (2 abreast).
- Max. coach: 20 (3 abreast).
- Volume of freight and baggage holds: 100 cu. ft. (1).

Powerplants
- Two Rolls-Royce Dart 529 (R.Da. 7/2).
- Take-off power each (I.S.A., s.l.): 2,105 e.h.p. at 15,000 r.p.m.
- Water methanol system provided.
- Rotol four-blade c.s., f.f. propellers, 11 ft. 6 in. diameter.

Weights and Loadings
- Basic operational: 21,770 lb.
- Total fuel: 10,400 lb.
- Mfrs. max. payload: 4,400 lb.
- Max. take-off: 33,600 lb.
- Max. landing: 32,000 lb.
- Max. zero fuel: 26,170 lb.
- Wing loading (max. t.-o. wt.): 54.6 lb./sq. ft.
- Wing loading (max. landing wt.): 52.0 lb./sq. ft.
- Power loading (max. t.-o. wt.): 8.45 lb./s.h.p.

Design Criteria
- Design limits: Vc/Mc : 290 k./0.54. Vne/Mne : 310 k./0.59.

Performance
- Recommended cont. cruising speed (I.S.A.): 307 knots (at 25,000 ft. and 28,000 lb.); consumption: 170 Imp. gal./hr.; power (per engine): 14,000 r.p.m.
- Approach speed (at max. landing wt.): 108.6 knots.
- Balanced field lengths (SR422A, at max. t.-o. wt.):
  - At I.S.A. at sea level: 4,330 ft.
  - At I.S.A. +15°C. at sea level: 4,680 ft.
  - At I.S.A. at 5,000 ft.: 5,045 ft.
- Landing distance required (SR422A, max. landing wt.): 2,500 ft.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (1,282 Imp. gal.): 2,300 naut mi. with 1,430 lb. payload at 304 knots (mean) at 25,000 ft. (mean).
- Range (take-off to landing) still air, no reserves, I.S.A., with max. payload 1,640 naut. mi.

Commercial Aircraft . . . .

The Douglas DC-8

Long-haul turbojet trunk-liner, in service September, 1959. First flown May, 1958. In production; 139 ordered

SECOND of the U.S. turbojet transports, the DC-8, has been in service since September 18 with United Air Lines and Delta Air Lines, the only operators, of the 18 which have ordered the DC-8, to specify the JT3A-powered domestic model. This earliest and lightest member of the DC-8 family was given its F.A.A. type certificate for unrestricted commercial operation on August 31. By the end of this year, Delta expects to have its full fleet of six 119-seat DC-8s on routes from Atlanta to New York, Chicago and Miami; United should have 16 of its 108-seat DC-8s at year-end and will extend its initial New York-San Francisco operation to include Los Angeles, Chicago and Washington.

Douglas certificated the DC-8 in exactly 15 months from the first flight date of May 30, 1958, using eight aeroplanes in the test programme. Second to fly, on November 29, 1958, was a JT4A-powered domestic model, which had been used for static testing prior to its first flight. Two more JT3C-engined domestic models flew in December, 1958. The fifth DC-8 was the first JT4A intercontinental model, and flew on February 21 this year. Like the next two DC-8s, this is destined in due course for Pan American. Number 8 off the line was another JT3C domestic, and on June 3 this DC-8 was formally delivered to United Airlines for familiarization and crew training.

The first Conway-engined DC-8, one of the T.C.A. fleet of six, flew on July 23, and is the eighth aircraft involved in the test programme—to be joined shortly by DC-8 No. 18, another Conway version. By September, 17 DC-8s had flown.

At the time of the DC-8's certification, 2,284 flight hours had been accumulated and 1,782 take-offs and landings had been made. The total included 1,302 hours of instrumented test flying—and this figure had risen to 1,419 hours by September 15.

A note on some aspects of DC-8 flight testing, referring particularly to flutter tests, by test pilot William H. Magruder, appeared in our issue for May 22, 1959. In this it was noted that flutter tests had been conducted over the speed range of 250 to 430 knots I.A.S. at lower altitudes and Mach 0.70 to 0.95 at high altitudes; these tests required over 100 hours, spread over 5½ months, and for their duration a parachute, able to provide 100,000 lb. of drag at the design diving speed, was installed in the tail.

In the course of flight development, several new features have been introduced on the DC-8. The unique Douglas-designed thrust brake, combined with the noise-suppressor "daisy," flew for the first time on No. 3, and is a standard feature of all production aircraft regardless of engine type. To meet the changed regulations for demonstrating take-off distance, promulgated in SR422A, and also to compensate for the considerable weight growth of the design, Douglas initiated a programme of leading-edge flap experiments on aircraft No. 2. As a result, fixed leading-edge slots will be introduced as standard on the 30th aircraft *et seq.* These slots are in two portions on each wing—a 34-in. section immediately inboard of each inner pylon, and an 80-in. section inboard of each outer pylon. They will reduce the stalling speed by 10 knots and take-off run by 1,000 ft.

Another noticeable modification, also on the 30th DC-8, is the increase in span, with an extra 16 inches at each tip and a change of profile. As the table printed here shows, increases have

(*Continued on page 355*)

Dimensions
Span: 142 ft. 5 in.
Overall length: 150 ft. 6 in.
Overall height: 42 ft. 4 in.
Gross wing area: 2,771 sq. ft.
Sweepback: 30° on 25% chord.
Internal cabin dimensions (ex. flight deck):
Length: 103 ft. 0 in.
Max. width: 140 in.
Max. height: 80 in.
Max. usable floor area 1,100 sq. ft.
Max. usable volume 7,945 cu. ft.

Accommodation
Normal first-class: 116 (5 abreast).
Normal tourist: 140 (6 abreast).
Max. coach: 176 (6 abreast).
Volume of freight and baggage holds: 1,390 cu. ft. in two holds.

Structure: Three-spar wing, assembled in one piece. Integral fuel tanks between front and rear spars. Monocoque elliptical-section fuselage.

Undercarriage: Four-wheel main bogies, inwards-retracting with castoring rear trucks for taxiing. Twin-wheel steerable nose wheel. Hydraulic brakes.

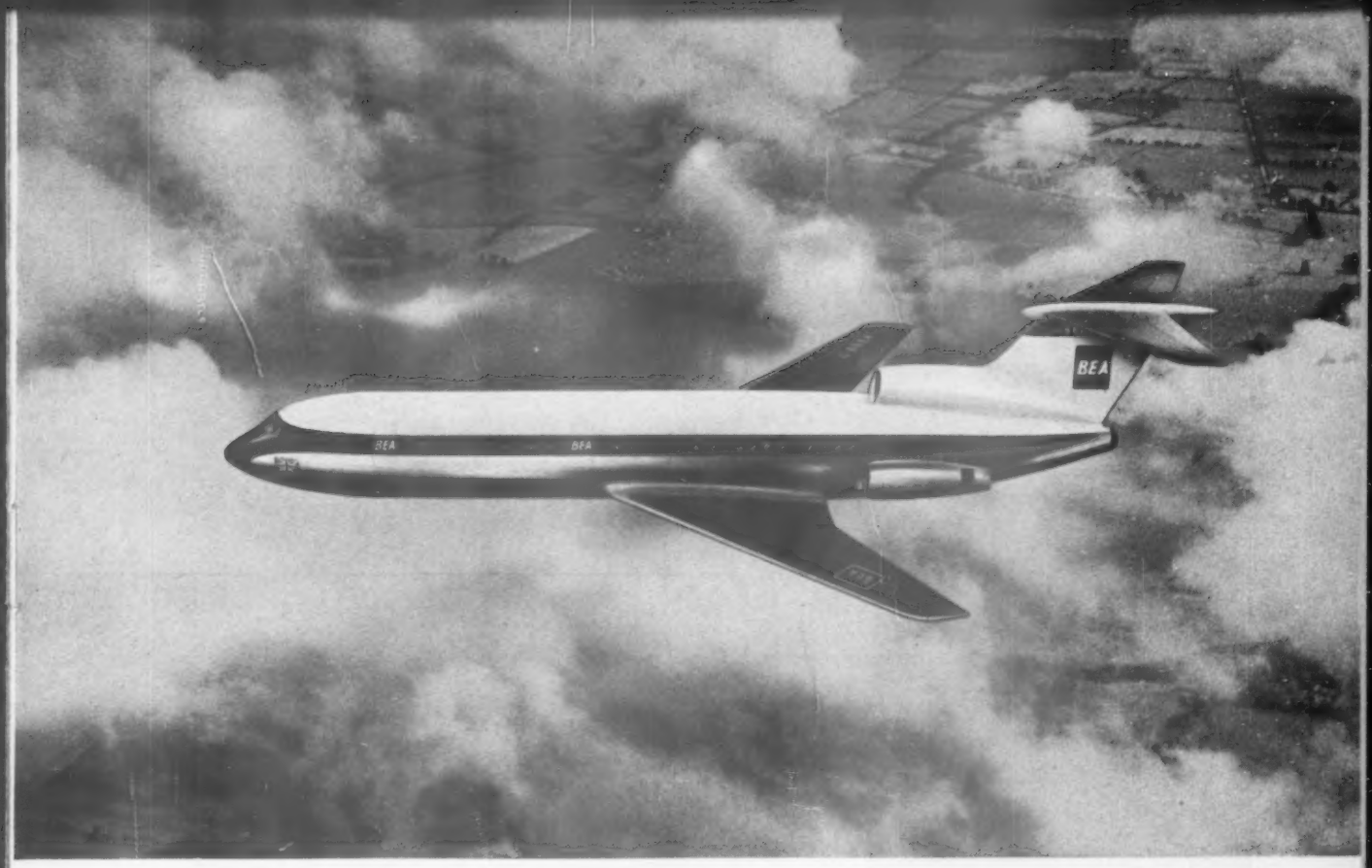
Flaps and Slots: Double-slotted, 30%-chord flaps in four portions. Two fixed leading edge slots each side, inboard of outer and inner pylons respectively.

Air Brakes: Four upper-wing spoilers, linked with nose-wheel, to destroy lift in landing; thrust-brake incorporated in suppressor.

Flying Controls: Interconnected two-piece ailerons each side; outer portions operate through pre-loaded torque link from inners at low speeds only; inners hydraulically boosted. Hydraulically boosted rudder. Manual elevator with aerodynamic tabs, and hydraulic v.i. tailplane.

Systems: Duplicated 3,000 p.s.i. hydraulic systems for power controls, flaps, u/c, brakes and nose-wheel steering. Four three-phase engine-driven generators for 120/208V., 400 cycle AC and four rectifiers for 28V. DC. De-icing of wings, tail unit and engine intakes by engine-bleed air; Nesa-glass windscreen and air-blast rain removal. Cabin pressurization at 8.77 p.s.i.; by four turbocompressors driven by engine compressed air. Four-point pressure refuelling at 1,400 g.p.m.

	Domestic	Domestic	Intercontinental	Intercontinental	Intercontinental
Powerplant:					
Type and number	4 JT3C-6	4 JT4A-3	4 JT4A-11	4 Conway 509	4 JT3D-1
Rated take-off power (i.s.a., s.l.), lb.s.t.	13,500	15,800	17,500	17,500	17,000
Weights:					
Basic operational, lb.	126,115	129,172	134,081	133,118	128,402
Total fuel, lb.	114,400	114,400	151,500	151,500	151,500
Mfr.'s max. payload, lb.	36,285	33,328	40,519	41,482	49,098
Max. take-off, lb.	273,000	276,000	310,000	310,000	310,000
Max. landing, lb.	190,500	189,000	199,500	199,500	199,500
Max. zero fuel, lb.	162,400	162,500	174,600	174,600	168,500
Loadings:					
Wing loading (max. t.-o. wt.) lb./sq. ft.	98.6	99.6	111.9	111.9	111.9
Wing loading (max. landing wt.) lb./sq. ft.	68.2	68.2	72.0	72.0	72.0
Power loading (max. t.-o. wt.), lb./lb.s.t.	5.06	4.37	4.43	4.43	4.56
Design Limit Speed:					
Mc/Vc, knots E.A.S.	0.88/340–356	0.88/340–356	0.88/340–356	0.88/340–356	0.88/340–356



AIRCO D.H. 121

(Rolls-Royce RB163 by-pass jet engines)

The ultimate 600 m.p.h. airliner for economical short-haul operations from 1963

Duty	Intended to replace Viscounts and Convair liners on regional networks with stages up to about 1,200 statute miles, *1920 km.*
Speed	The ultimate in sub-sonic speed. Maximum cruising speed is 606 m.p.h., *970 km/hr.*—M.O.875 at 25,000 ft., *7620 m.*
	Speed for best operating economy is 585 m.p.h., *936 km/hr.* — M.O.87 at 32,000 ft., *9753 m.;* this is faster than claimed for any other commercial jet.
Economy	A.T.A. cost per seat mile 1·04 cents, assuming 900 miles stage with 97 economy-class seats.
Size	Capacity is designed for expected increases in traffic and frequency in the 1960s and onwards.
Turnaround	Able to operate stopping services without intermediate refuelling.
Airfield Performance	Able to use, with full load, runways less than 6,000 ft., *1829 m.* long. Docile handling. Will have automatic landing for safe all-weather operation.
Engines	Three Rolls-Royce RB163 by-pass jets, each 10,100 lb. thrust. Efficiency with reliability.
Quietness	Rear-mounted engines with jet-noise suppressors give exceptionally quiet cabin, an exterior noise no more than present propeller-driven short-haul liners.
Experience and Resources	Combination of unequalled experience in jet-airliner development and high-speed flight, with formidable industrial resources.

AIRCRAFT MANUFACTURING COMPANY LIMITED

Hunting *de Havilland* *Fairey*

EN PASSANT

One of a series of drawings by Colin Munro

Today the British Aircraft Industry is developing new aircraft designed specifically for the commercial operator who requires a freight aeroplane. Teddington Aircraft Controls Limited are proud that their equipment figures in the specifications of these, the "tramp steamers" of the airways. * Pressure Switches * Cabin Conditioning Equipment * Hot Air Valves * Solenoid Valves * Anticing Equipment * Fuel Tank Venting Equipment

Teddington CONTROLS

TEDDINGTON AIRCRAFT CONTROLS LTD · MERTHYR TYDFIL · SOUTH WALES · Tel: Merthyr Tydfil 3261
London Office: COLNBROOK BY-PASS · WEST DRAYTON · MIDDLESEX · Telephone: Colnbrook 2202/3/4

TAC 201

Commercial Aircraft . . . .

(*Continued from page 354*)

recently been made in the gross weights of both domestic models of the DC-8.

At least seven variants of the DC-8 have now been ordered by the airlines. Details of the seven types, all of which are dimensionally similar, are as follow: domestic model with JT3C-6 engines, 14,680 Imp. gallons fuel and 273,000 lb. weight; domestic model with JT4A-3 engines, 14,680 Imp. gallons fuel and 276,000 lb. weight; intercontinental model with JT4A-3 engines, 18,000 Imp. gallons fuel and 300,000 lb. weight, and an equivalent model with 16,500 lb.s.t. Conway 507 engines; intercontinental model with JT4A-11 engines, 19,420 Imp. gallons fuel and 310,000 lb. weight, and equivalent models with Conway 509 and JT3D turbofans.

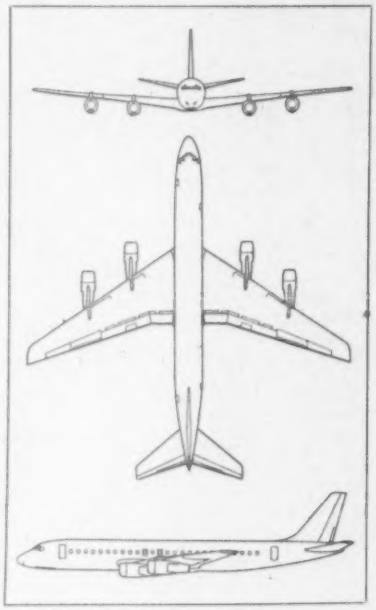
The turbofan version of the DC-8, newest model announced, has been ordered by K.L.M. and both Delta and United have expressed interest in converting their early domestic models to have these engines later. The JT3D engine will also be used in a prototype DC-8 freighter, with swing tail, which Douglas is reported to be building.

Certification of the JT4A domestic model is scheduled for December this year, and the Conway version should get its certificate next February.

In the accompanying data for the DC-8 variants, performance details have been excluded at the request of the manufacturers, who explain that "none of the figures have been certified, but most of them will have been demonstrated during the useful life of the publication. We do not care to have inaccurate or estimated data in print which might be at variance from the ultimately established performance." Cruising speeds are generally of the order of 510 knots at 30,000 ft. at 220,000 lb. weight, and a typical range for the model with JT3D turbofans and 132 passengers is 4,760 naut. miles with airline reserves.

Order Summary

Alitalia, 4 Intercontinental (Conway 509); Delta, 6 Domestic (JT3C); Eastern, 16 Domestic (JT4A); Japan Air Lines, 4 Intercontinental (JT4A-11); K.L.M., 7 Intercontinental (JT4A) and 5 Intercontinental (JT3D); National, 3 Domestic (JT4A); Northwest, 5 Intercontinental (JT4A-11); Olympic, 2 International (JT4A); Pan American, 17 Intercontinental (JT4A); Panagra, 4 Intercontinental (JT4A); Panair do Brasil, 4 Intercontinental (JT4A); S.A.S., 7 Intercontinental (JT4A); Swissair, 3 Intercontinental (JT4A); T.A.I., 2 Intercontinental (JT4A); T.C.A., 6 Intercontinental (Conway); U.A.T., 2 Intercontinental (JT4A); United, 18 Domestic (JT3C) and 22 Domestic (JT4A); P.A.L., 2 Intercontinental (JT4A).

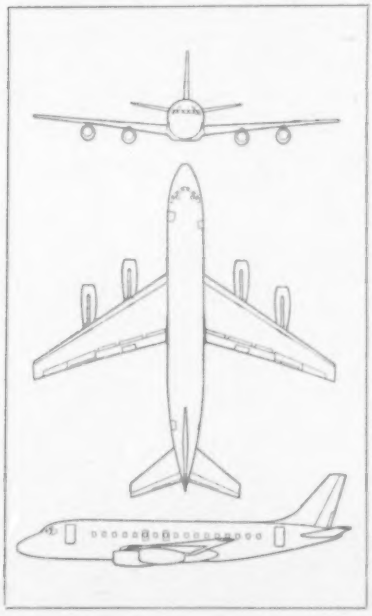


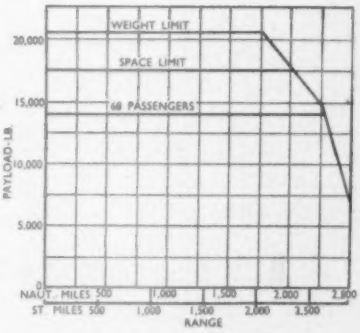
The Douglas DC-9

AFTER more than three years, Douglas have recently "frozen" their DC-9 project and have published details for the first time. It has been an open secret since 1956 that the company was interested in the possibility of building a smaller edition of the DC-8 for medium-short-haul operations. Since that time, the project has taken many different forms and sizes, and it was not until the advent of the turbofan engines and the completion of the major design effort on the DC-8 that Douglas felt ready to reach a reasonably final decision.

The DC-9 as now offered to the airlines is shown here, but even since this information was issued by the company, in June, there have been reports that some airlines would favour a version with two 17,000-lb. JT3D turbofans in place of the newer 8,250-lb. JT10As, and this arrangement may be built instead of, or as well as, the four-engine version.

Until 75-100 DC-9s have been ordered, Douglas will not embark on major production, but deliveries in early 1963 are offered against orders placed now, which suggests that detail design must be well along and some preliminary tooling in hand.





Dimensions
Span: 94 ft. 0 in.
Overall length: 103 ft. 0 in.
Overall height: 34 ft. 0 in.
Gross wing area: 1,285 sq. ft.
Sweepback: 30° on 25% chord.
Internal cabin dimensions:
Length (ex. flight deck): 71 ft. 0 in.
Max. width: 124 in.
Max. height: 81 in.

Accommodation
Normal first-class: 68 (5 abreast).
Max. coach: 92 (5 abreast).
Volume of freight and baggage holds: 609 cu. ft.

Powerplants
Four Pratt & Whitney JTF-10A-1 turbofans.
Take-off power each (90°F., s.l.): 8,250 lb.s.t.
Douglas thrust reversers each engine.

Weights and Loadings
Mfrs. max. payload: 20,355 lb.
Max. take-off: 120,000 lb.
Max. landing: 98,000 lb.
Max. zero fuel: 87,000 lb.
Wing loading (max. t.-o. wt.): 93.3 lb./sq. ft.
Wing loading (max. landing wt.): 76.2 lb./sq. ft.
Power loading (max. t.-o. wt.): 3.6 lb./lb.s.t.

Performance
Cont. cruising speed (I.S.A.): 480 knots (at 35,000 ft.).
F.A.A. t.-o. field lengths (at max. t.-o. wt.):
At I.S.A. at sea level: 6,030 ft.
At I.S.A. +22.8°C. at sea level: 6,840 ft.
At I.S.A. at 4,000 ft.: 7,700 ft.
F.A.A. landing distance required (max. landing wt.): 4,800 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel: 2,900 naut. mi. with 14,500 lb. payload at 480 knots (mean) at 35,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max. payload: 2,350 naut. mi.

Structure: As DC-8.

Undercarriage: Twin-wheel main wheels retract sideways into fuselage. Twin-wheel nose wheel retracts forwards.

Flaps and Slats: 28% chord, double slotted flaps in one piece each side. 15% chord leading-edge slats. Hydraulic operation.

Flying Controls: Hydraulically boosted, with tab-boost for manual back-up. Three spoilers ahead of flaps, each side, serve as lift dumpers and two sections each side operate in conjunction with ailerons when u/c is down.

Systems: Independent 3,000 p.s.i. hydraulic systems. 115V, 3-phase, 400 c.p.s. AC electrics from engine-driven alternators. Two turbo-compressors for cabin conditioning and pressurization at 8.77 p.s.i.

Commercial Aircraft . . . .

Fokker/Fairchild F-27

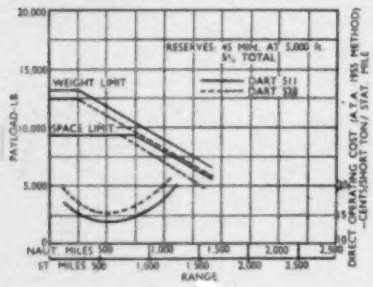
Short-haul turboprop feeder-liner, in service since September, 1958. First flown November, 1955. In production ; 130 ordered.

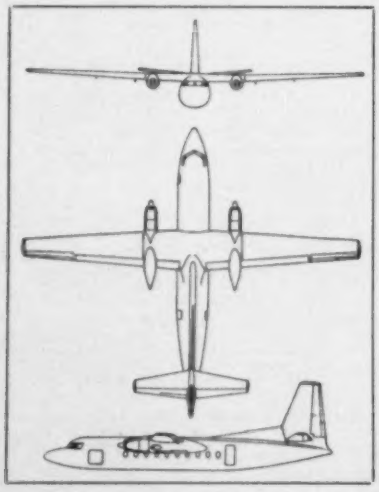
THE Friendship went into service a year ago, on September 28, when West Coast Airlines started operating three Fairchild-built F-27s over its Pacific north-west network. This was the first occasion when an American-built turbine transport had been used for scheduled service and preceded by three months the introduction of the first Fokker-built F-27s by Aer Lingus. F.A.A. certification was obtained on July 30, 1958.

Deliveries from both the Fairchild and Fokker factories have been mounting steadily during the year, to meet the existing firm orders for a total of 130 aircraft. The two production lines produce closely similar aircraft, but the Fairchild model has a slightly longer radar-mounting nose, Stratos air-conditioning system, integral stairs and minor engineering changes. Both companies offer three basic models: the F-27 with Dart 511, the F-27A with Dart 528 and the F-27B cargo-convertible with freight floor and door. The first F-27A was delivered to Pacific Air Lines in March, 1959, and the first F-27B to Northern Consolidated in October, 1958.

Towards the end of 1958, Fokker initiated modification action to strengthen the lower skin of the wing centre-section, after serious cracks occurred in the water-tank specimen. This modification is expected to be more than adequate to give the Friendship a safe life of 30,000 hours.

The Dutch F-27 sells at $620,000 less radio, and the F-27A at $690,000 less radio. Basic Fairchild prices are $635,000 and $695,000 respectively.


RESERVES 45 MIN. AT 5,000 ft. 5% TOTAL
WEIGHT LIMIT
SPACE LIMIT
DART 511
DART 528
PAYLOAD-LB
DIRECT OPERATING COST (I.A.T.A. 1955 METHOD) —CENTS/SHORT TON/STAT. MILE
NAUT. MILES 500 1,000 1,500 2,000 2,500
ST. MILES 500 1,000 1,500 2,000 2,500
RANGE



Order Summary

(With dates of first delivery)

Fokker production: Aer Lingus, 7, Nov., 1958; Ansett-A.N.A., 6, Sept., 1959; Australian D.C.A., 2, Sept., 1959; Braathens S.A.F.E., 2, Dec., 1958; East-West Airlines, 1, July, 1959; K.L.M., 2, March, 1960; Mac.Robertson Miller Airlines, 1, Nov., 1959; Netherlands D.C.A. (Royal Flight), 1, March, 1960; Pakistan International, 3, 1960; Philippine Air Lines, 2, Feb., 1960; R. Neth. A.F., 12, 1960; T.A.A., 10, April 6, 1959. Miscellaneous executive, etc., 6, options and repeats in negotiation, 27.

Fairchild production: Aerovias Ecuatorianas, 1; Avensa, 5, Sept., 1958; Aloha Airlines, 6, May, 1959; Bonanza Air Lines, 10, Feb., 1959; Northern Consolidated Airlines, 3, Oct., 1958; Ozark Air Lines, 3; Pacific Airlines, 6, March, 1959; Piedmont Airlines, 8, Oct., 1958; Quebecair, 3, Sept., 1958; Trans Mar de Cortes, 1, Dec., 1958; West Coast Airlines, 6, Aug., 1958; Wien Alaska Airlines, 2, June, 1959. Miscellaneous executive, unannounced orders, etc., 21.

Dimensions
Span: 95 ft. 2 in.
Overall length: 75 ft. 9 in.
Overall height: 27 ft. 6 in.
Gross wing area: 754 sq. ft.
Sweepback: Nil.
Internal cabin dimensions:
Length (ex. flight deck): 47 ft. 6 in.
Max. width: 100 in.
Max. height: 80 in.
Max. usable floor area (ex. flight deck): 266 sq. ft.
Max. usable volume (ex. flight deck): 2,118 cu. ft.

Accommodation
Normal first-class: 36 (4 abreast).
Normal tourist: 40 (4 abreast).
Max. coach: 48 (4 abreast).
Volume of freight and baggage holds: Nil.

Structure: Two-spar wing comprising centre section, outer panels and tips, with Redux bonding. Integral fuel tanks in outer panels. Semi-monocoque oval-section fuselage. Principal materials, 75S-T6 and 24S-T4 alloy.

Undercarriage: Twin wheel main units, retracting rearwards. Twin-wheel steerable nose-wheel, forwards-retracting. Pneumatic brakes.

Flaps: Single-slotted in one piece each side, electrically actuated.

Air Brakes: None.

Flying Controls: Manual, aerodynamically balanced ailerons with trim, spring and servo tabs; manual, aerodynamically balanced elevator and rudder, the latter with geared and trim tabs.

Systems: Two independent 3,300 p.s.i. pneumatic systems powered by engine-driven compressors for u/c, nose-wheel steering and wheel brakes. Primary 24-28V. DC electric system from two engine-mounted generators and secondary three-phase 115V. 400-cycle AC circuit from two inverters. Cabin pressurization 4.16 p.s.i. by two engine-driven compressors. De-icing of wing and tail unit by rubber boots; electrical de-icing of intakes, propellers, spinners, and windshield.

F-27

Powerplants
Two Rolls-Royce Dart 511 (R.Da. 6).
Take-off power each (I.S.A., s.l.): 1,720 e.h.p. at 14,500 r.p.m.
Rotol c.s., f.f., four-blade propellers, 12 ft. diameter.
Water injection system provided.

Weights and Loadings
Basic operational: 22,770 lb.
Total fuel: 8,844 lb.
Mfrs. max. payload: 13,000 lb.
Space-limited payload: 9,200 lb.
Max. take-off: 37,500 lb.
Max. landing: 35,700 lb.
Max. zero fuel: 35,700 lb.
Wing loading (max. t.-o. wt.): 49.8 lb./sq. ft.
Wing loading (max. landing wt.): 47.4 lb./sq. ft.
Power loading (max. t.-o. wt.): 10.9 lb./e.h.p.

Design Criteria
Design limit speeds: Vc=227 k. Vne=259 k. Md=288 k.

Performance
Recommended cont. cruising speed (I.S.A.): 233 knots (at 20,000 ft. and 36,000 lb.); consumption: 156 Imp. gal/hr.
Approach speed (at max. landing wt.): 90 knots.
Balanced field lengths (SR422A at max. t.-o. wt.):
At I.S.A. at sea level: 4,760 ft.
At I.S.A. + 15°C. at sea level: 5,100 ft. at 35,000 lb.
At I.S.A. at 5,000 ft.: 5,930 ft.
Landing distance (SR422A, max. landing wt.): 3,640 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (1,130 Imp. gal): 1,600 naut. mi. with 5,500 lb. payload at 229 knots (mean) at 20,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max. space-limited payload: 950 naut. mi.

F-27A

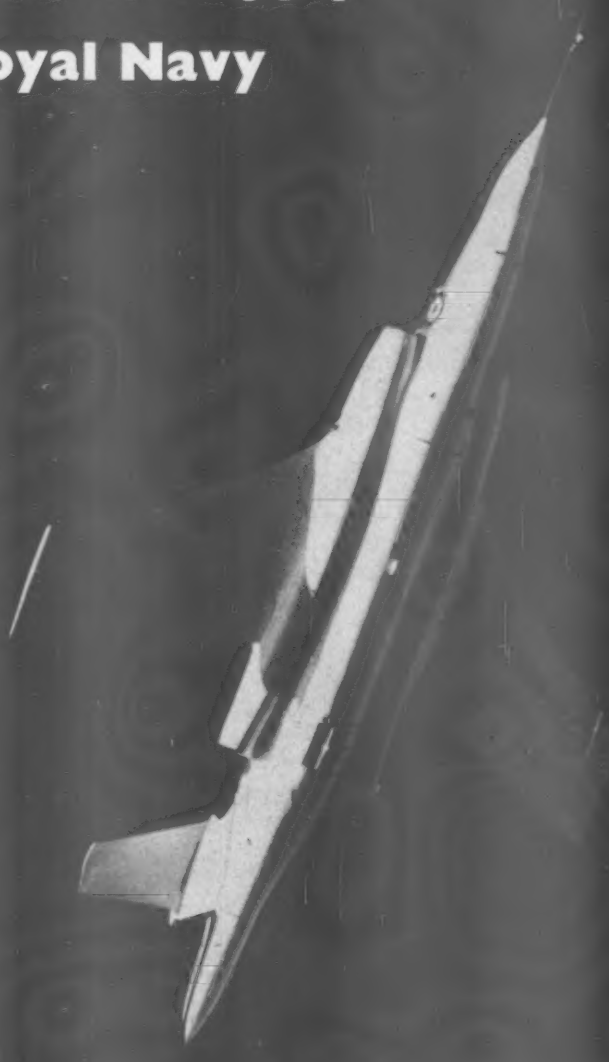
Powerplants
Two Rolls-Royce Dart 528 (R.Da. 7).
Take-off power each (I.S.A., s.l.): 2,105 e.h.p. at 15,000 r.p.m.
Rotol c.s., f.f., four-blade propellers, 11 ft. 6 in. diameter.
Water injection system provided.

Weights and loadings
Basic operational: 23,286 lb.
Total fuel: 8,844 lb.
Mfrs. max. payload: 12,500 lb.
Space-limited payload: 9,200 lb.
Max. take-off: 37,500 lb.
Max. landing: 35,700 lb.
Max. zero fuel: 35,700 lb.
Wing loading (max. t.-o. wt.): 49.8 lb./sq. ft.
Wing loading (max. landing wt.): 47.4 lb./sq. ft.
Power loading (max. t.-o. wt.): 8.9 lb./e.h.p.

Design Criteria
Design limit speeds: Vc=227 k. Vne=259 k. Vd=288 k.

Performance
Recommended cont. cruising speed (I.S.A.): 260 knots (at 20,000 ft. and 36,000 lb.); consumption: 179 Imp. gal./hr.
Approach speed (at max. landing wt.): 90 knots.
Balanced field lengths (SR422A at max. t.-o. wt.):
At I.S.A. at sea level: 3,450 ft.
At I.S.A. +15°C. at sea level: 3,900 ft. at 36,000 lb.
At I.S.A. at 5,000 ft.: 5,150 ft.
Landing distance (SR422A, max. landing wt.): 3,640 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (1,130 Imp. gal.): 1,510 naut. mi. with 5,000 lb. payload at 232 knots (mean) at 20,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max. space-limited payload: 800 naut. mi.

The NA.39 has been ordered by The Ministry of Supply for the Royal Navy



BLACKBURN AIRCRAFT LIMITED BROUGH YORKSHIRE ENGLAND

A1317

Firestone

Sky Champion

GEAR GRIP AEROPLANE TYRE

A nylon cord tyre developed to give more landings and longer body life than any other tyre in use on main or nose wheels of commercial aircraft.

1. Flatter profile for longer wear.
2. Fewer and wider ribs for longer wear.
3. New tread rubber of increased efficiency for longer wear.
4. Skid resistors to increase traction and decrease tendency to skid burn.
5. Sized to permit increased clearance in wheel nacelles.
6. Safety-tensioned, Gum-dipped nylon cords and improved body stock give longer tyre body life.

More landings per tread—more treads per carcass

Many sizes also available in Ribbed pattern

EXPERIENCE COUNTS

45 Factories throughout the world. Firestone total sales exceed £1,000,000 per day.

Firestone TYRES
consistently good

FIRESTONE TYRE & RUBBER COMPANY LTD., GREAT WEST ROAD, BRENTFORD, MIDDLESEX · A.I.D., A.R.B. & C.A.A. APPROVED

Commercial Aircraft . . . .

Short-to-medium-haul turboprop trunk-liner in service since January, 1959. First flown December, 1957. In production, 167 ordered

The Lockheed Electra

EASTERN AIRLINES put the Electra into scheduled service on January 12 this year, after a delay of more than a month caused by the series of aircrew strikes at the end of 1958. The first of Eastern's fleet of 40 Electras (the fifth from the production line) had flown on May 19, 1958, and the airline took delivery of its first two aircraft at Miami in October. The first for American Airlines was handed over in November, 1958, and this company put the type into operation on January 23, 1959.

Flight trials for certification by the C.A.A. began in June, 1958, some six months after the first Electra flew on December 6, 1957. With Electra No. 1 used to confirm the preliminary test figures and No. 4 used for function and reliability testing (165 hours in 10 days), the official trials occupied about two months and the type approval was granted on August 22. All performance guarantees were met or exceeded, without using specified tolerances, and an increase in gross weight to 116,000 lb. was authorized for introduction from the 20th Electra onwards.

This weight is applicable to the L-188C, data and curves for which are printed here. Both domestic and international models are available, K.L.M. being the first company to obtain the international L-188C, which began its flight trials in June this year. The L-188C has optional extra fuel capacity, in wing fillet tanks, of some 750 Imp. gallons, and the international version differs in layout of the flight deck, to provide a navigator's station, and in the equipment carried.

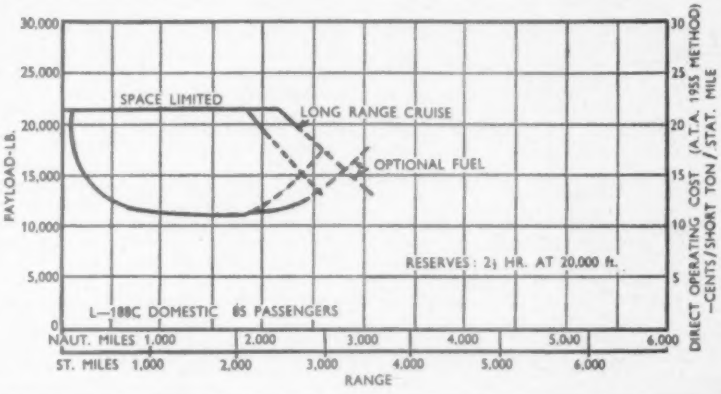
In October and November, 1958, one of Lockheed's four privately financed prototypes completed a 52,000-mile World tour, visiting 32 cities and military bases in 19 countries. This and another prototype have now been sold to Cathay Pacific Airways which, with Ansett-A.N.A., became the first overseas Electra operator.

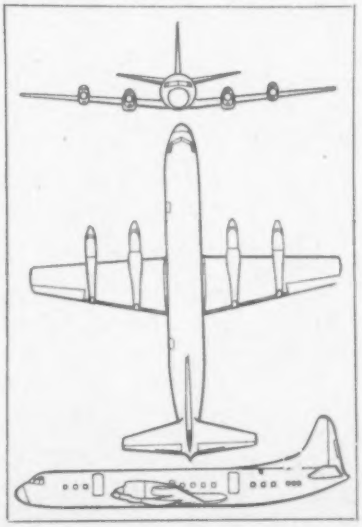
Last month, an Electra began a 16,600-mile demonstration tour of Central and South America. By the beginning of October, 91 Electras had been delivered to nine airlines, and 75,000 revenue service hours had been flown. Current basic price of the Electra is $2,290,700 for the equipped aeroplane.

Order Summary

(First delivery dates are given to the nearest quarter)

American Airlines, 35, 3rd qtr., 1958; Ansett-A.N.A., 2, 1st qtr., 1959; Braniff, 9, 2nd qtr., 1959; Cathay Pacific, 2, 2nd qtr., 1959; Eastern, 40, 4th qtr., 1958; Garuda, 3, 3rd qtr., 1960; General Motors, 1, 3rd qtr., 1958; K.L.M., 12, 3rd qtr., 1959; National, 23, 2nd qtr., 1959; Northwest, 18, 3rd qtr., 1959; Pacific Southwest, 4, 4th qtr., 1959; Qantas, 4, 4th qtr., 1959; TEAL, 3, 4th qtr., 1959; T.A.A., 2, 2nd qtr., 1959; Western Air Lines, 9, 2nd qtr., 1959.





Dimensions
Span: 99 ft. 0 in.
Overall length: 104 ft. 6½ in.
Overall height: 32 ft. 11½ in.
Gross wing area: 1,300 sq. ft.
Sweepback: Nil.
Internal cabin dimensions:
Length (ex flight deck): 76 ft. 5 in.
Max. width: 128 in.
Max. height: 100 in.
Max. usable floor area (ex flight deck): 704 sq. ft.
Max. usable volume (ex flight deck): 4,812 cu. ft.

Accommodation
Normal first-class: 66* (4 abreast).
Normal tourist: 85* (5 abreast).
Max. coach: 99 (6 abreast).
Volume of freight and baggage holds: 524 cu. ft. in two holds.
* Plus six in rear lounge.

Powerplants
Four Allison 501-D13.
Take-off power each (I.S.A., s.l.): 3,750 e.h.p. at 13,820 r.p.m.
Water injection system installed.
Aeroproducts A6441FN-606 four-blade reversing propellers, 13 ft. 6 in. diameter.

Weights and Loadings
Basic operational: 59,698 lb.
Total fuel: 35,912 lb.
Mfrs. max. payload: 26,735 lb.
Max. take-off: 116,000 lb.
Max. landing: 95,650 lb.
Max. zero fuel: 86,000 lb.
Wing loading (max. t.-o. wt.): 89.2 lb./sq. ft.
Wing loading (max. landing wt.): 73.6 lb./sq. ft.
Power loading (max. t.-o. wt.): 7.5 lb./e.h.p.

Design Criteria
Design limits: Mc/Vc=.615 (324 k.) Vne=364 k. Md/Vd=.711 (405 k.)

Performance
Recommended cont. cruising speed (I.S.A.): 352 knots (at 22,000 ft. and 85,500 lb.); consumption: 501 Imp. gal./hr.; power (per engine): 90% MRT.
Approach speed (at max. landing wt.): 121 knots.
Balanced field lengths (at max. t.-o. wt.): At I.S.A. at sea level: 5,500 ft.
At I.S.A.+15°C. at sea level: 6,700 ft.
At I.S.A. at 5,000 ft.: 7,850 ft.
Landing field length required (unfactored, max. landing wt.): 4,870 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (4,460 Imp. gal.): 3,850 naut. mi. with 13,200 lb. payload at 325 knots (mean) at 17,000 ft. (mean).
Range (take-off to landing), still air, no reserves, I.S.A., with 21,235 lb. (85 pass.) 3,000 naut. mi.

Structure: Two-spar box-beam wing in two main units joined to 12-ft. 10-in. span centre section integral with fuselage. Extruded, integrally stiffened wing skins. Four integral fuel tanks. Semi-monocoque circular-section fuselage.

Undercarriage: Twin-wheel main units, backward retracting, and twin-wheel steerable nosewheel. Hydraulic brakes.

Flaps: Fowler-type in one piece each side.

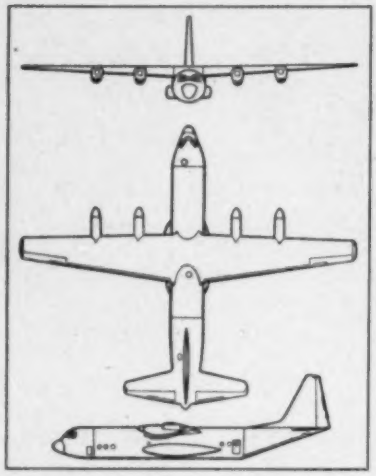
Air Brakes: Three-piece, under fuselage between the flaps.

Flying Controls: Hydraulically boosted ailerons, elevator and rudder, with manual by-pass and manual trim.

Systems: Two independent 3,000 p.s.i. hydraulic systems, with three electrically driven hydraulic pumps, for power controls, flaps, u/c, brakes, nose-wheel steering. Four engine-driven 60-kVA. generators for 120/208V. 400-cycle 3-phase AC, and two rectifiers for 28V. DC; 24V. battery. Cabin pressurization at 6.5 p.s.i. by two engine-driven compressors. Freon vapour-cycle and two independent air-cycle cooling systems. Airframe de-icing by engine-bleed air. Single-point pressure refuelling at 300 g.p.m.

Commercial Aircraft . . .

The Lockheed Super Hercules



Dimensions
Span: 145 ft. 0 in.
Overall length: 122 ft. 2 in.
Overall height: 38 ft. 0 in.
Gross wing area: 2,041 sq. ft.
Sweepback: Nil.
Internal cabin dimensions:
Length (ex. flight deck): 64 ft. 7 in.
Max. width: 123 in.
Max. height: 109 in.
Max. usable floor area (ex. flight deck): 662 sq. ft.
Max. usable volume (ex. flight deck): 7,070 cu. ft.

Powerplants
Four Allison 550-87
Take-off power each (I.S.A., s.l.): 6,500 h.p.
Water injection system available.
Four-blade 17 ft. diameter reversing propellers.

Weights and Loadings
Basic operational: 93,860 lb.
Total fuel: 77,130 lb.
Mfrs. max. payload: 76,240 lb.
Max. take-off: 230,000 lb.
Max. landing: 182,500 lb.
Max. zero fuel: 170,100 lb.
Wing loading (max. t.-o. wt.): 112.2 lb./sq. ft.
Wing loading (max. landing wt.): 89.4 lb./sq. ft.
Power loading (max. t.-o. wt.): 8.8 lb./h.p.

Design Criteria
Design limit speeds: Mc/Vc: 0.64/270 k. Mne/Vne: 0.66/297 k. Md/Vd: 0.71/330 k.

Performance
Recommended cont. cruising speed (I.S.A.): 333 knots (at 20,000 ft. and 205,000 lb.); consumption: 795 Imp. gal./hr.; power (per engine): 92.5% max.
Approach speed (at max. landing wt.): 128 knots.
Balanced field lengths (SR422A, max. t.-o. wt.):
At I.S.A. at sea level: 7,250 ft.
At I.S.A. +15°C. at sea level: 9,800 ft.
At I.S.A. at 5,000 ft.: 10,050 ft.
Landing distance required (SR422A, max. landing wt.): 5,950 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (9,586 Imp. gal): 4,814 naut. mi. with 59,710 lb. payload at 324 knots (mean) at 28,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max. payload, 3,564 naut. mi.

DETAILS of the Super Hercules were first announced by Lockheed in April this year, when it was described as a "growth version" of the C-130 Hercules which would be offered both to military services and to commercial air-freight operators. Retaining the same layout as the Hercules, the GL-207 is larger all round, with more power and greatly increased gross weight.

The two airline orders for the Super Hercules announced in July were both conditional upon military backing being obtained for the project by September 30. This, it appears, has not been forthcoming, so Slick and Pan American are free to break their contracts if they wish. The Allison T61 powerplants are being developed with military funds, and, as this engine has no announced application other than in the GL-207, U.S.A.F. interest can be inferred and positive support probably only awaits the release of funds.

Deliveries of the Super Hercules are promised for early 1962 if the project goes ahead. It will be built at Lockheed's Marietta, Georgia, factory, where much of the C-130B tooling could be used for the new aircraft. Although intended as a pure freighter, the GL-207 could accommodate 104 passengers in airline seats.

ORDER SUMMARY

(With dates of first deliveries)

Slick Airways, 6 (+5), $22m., early 1962; Pan American World Airways, 12 (+12), $60m., early 1962.

The Lockheed JetStar

THE JetStar was "conceived, engineered and built with company funds in less than eight months" in 1957, to answer a U.S.A.F. request for a jet utility transport. Since the first flight on September 4, 1957, two prototypes, each with two Bristol Siddeley Orpheus turbojets, have been thoroughly tested and, although the anticipated military order has still to be placed, commercial interest in the JetStar as an executive aeroplane is such that Lockheed have put the type into production at Marietta.

Production models will have four JT-12 engines and increased weight, with refinements including thrust reversers, leading-edge flaps, dual main and nose wheels and many detail engineering improvements. One of the prototypes is expected to fly with four JT-12s in December.

Lockheed have estimated the seat-mile operating costs of the production JetStar to be 2.6 cents per seat-mile (carrying 10 passengers) assuming 600 hours' annual utilization, 1,500 naut. mile stages and no crew costs, depreciation, or insurance.

First JetStar delivery is scheduled for September, 1960—ahead of certification—to Pratt & Whitney. Other announced orders are from Continental Can Co. (January, 1961), Ryder System, Inc. (1961) and the Canadian Department of Transport (June, 1961).

Dimensions
Span: 53 ft. 8 in.
Overall length: 60 ft. 6 in.
Overall height: 20 ft. 6 in.
Gross wing area: 542.5 sq. ft.
Sweepback: 30° at 25% chord.
Internal cabin dimensions:
Length (ex. flight deck): 28 ft. 2 in.
Max. width: 80 in.
Max. height: 74 in.
Max. usable floor area (ex. flight deck): 136 sq. ft.
Max. usable volume (ex. flight deck): 716 cu. ft.

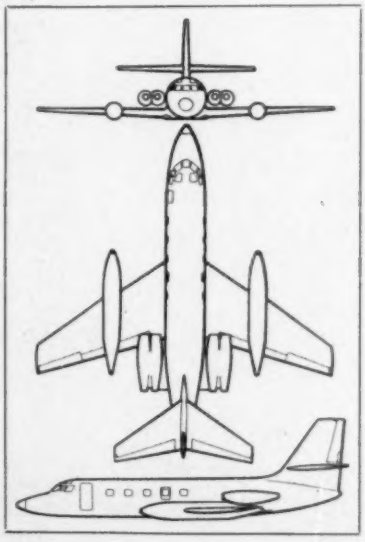
Accommodation
Normal first-class: 8 (2 abreast).
Normal tourist: 10 (2 abreast).
Max. coach: 17 (3 abreast).
Volume of freight and baggage holds: Nil.

Powerplants
Four Pratt & Whitney JT-12A-6.
Take-off power each (I.S.A., s.l.): 3,000 lb.s.t. at 16,000 r.p.m.
Thrust reversers each engine. No silencers or water injection.

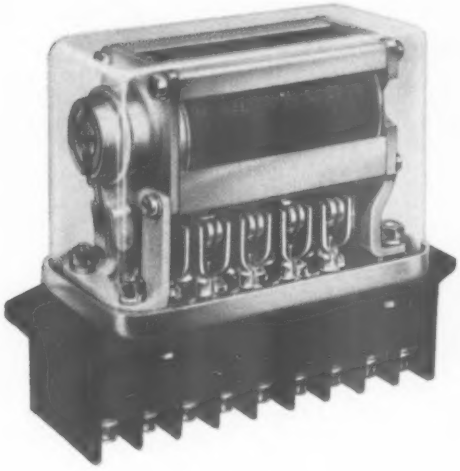
Weights and Loadings
Basic operational: 19,361 lb.
Total fuel: 17,621 lb.
Mfrs. max. payload: 2,439 lb.
Max. take-off: 38,930 lb.
Max. landing: 28,000 lb.
Max. zero fuel: 21,800 lb.
Wing loading (max. t.-o. wt.): 71.7 lb./sq. ft.
Wing loading (max. landing wt.): 51.7 lb./sq. ft.
Power loading (max. t.-o. wt.): 3.24 lb./lb.s.t.

Design Criteria
Design limit speeds: Mc/Vc=0.82/350 k. Mne/Vne=0.87/383 k. Md/Vd=0.90/425 k.

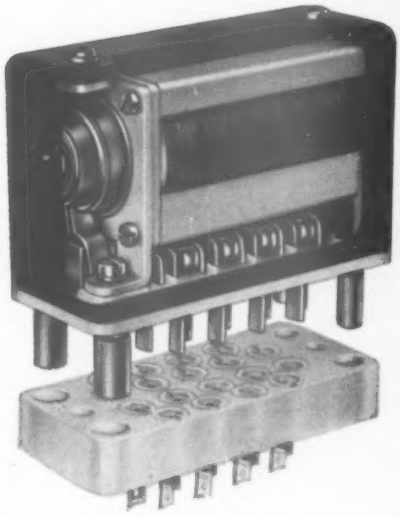
Performance
Recommended cont. cruising speed (I.S.A.): 445 knots (at 45,000 ft. and 25,000 lb.); consumption: 253 Imp. gal./hr.; power (per engine): 90% normal.
Approach speed (at max. landing wt.): 130 knots.
Balanced field lengths (SR422A, at max. t.-o. wt.):
At I.S.A. at sea level: 7,000 ft.
At I.S.A. +15°C. at sea level: 9,100 ft.
At I.S.A. at 5,000 ft.: 9,300 ft.
Landing distance required (SR422A, max. landing wt.): 5,000 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (2,190 Imp. gal.): 2,840 naut. mi. with 1,948 lb. payload at 416 knots (mean) at 40,000 ft. (mean).
Range (take-off to landing), still air, no reserves, I.S.A., with max. payload 2,580 naut. mi.



Plessey



The Plessey Hermetically Sealed Relay *offers the ideal practical solution to many problems. Techniques producing perfect hermetic sealing have been developed by Plessey, ensuring absolute reliability under the severest atmospheric conditions.*

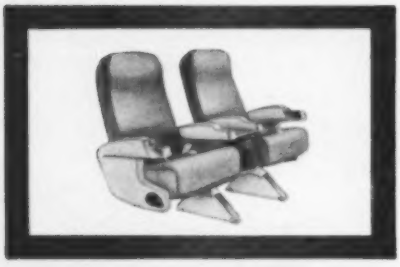


The Plessey Plug-in 'S' Type Relay *with detachable dust cover. The plug-in feature enables speedy replacement — without disturbing the wiring — and checking of both circuit wiring and relay operation.*

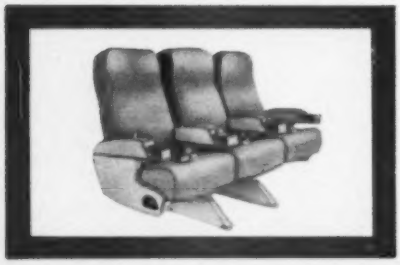
'S' Type Relays

Microcell *Executive* Aircraft Seating

FOR
B·O·A·C
FIRST CLASS AND DE-LUXE TRAVEL



DE-LUXE "EXECUTIVE" SEAT.
For special luxury accommodation. This unit is basically similar to the normal twin unit but incorporates a wide contemporary styled cabinet and tray unit, between the two seat places.



EXECUTIVE TRIPLE UNIT AIRCRAFT SEAT
Available also as Twin Unit for forward or aft facing

THE MICROCELL "EXECUTIVE" AIRCRAFT SEAT is unique in combining the simplest possible structure with the fulfilment of all known operational requirements.

This has been accomplished by adopting "Single Beam Unit Construction", an original concept in the use of standardised and therefore readily interchangeable components.

Microcell Aircraft

A Division of Microcell Limited
9, Kingsway, London, W.C.2
Telephone: Covent Garden 1262

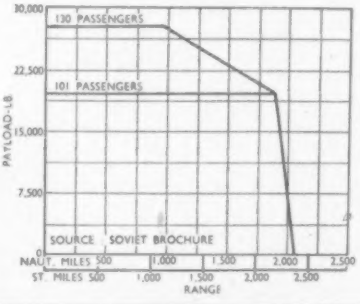
Commercial Aircraft . . . .

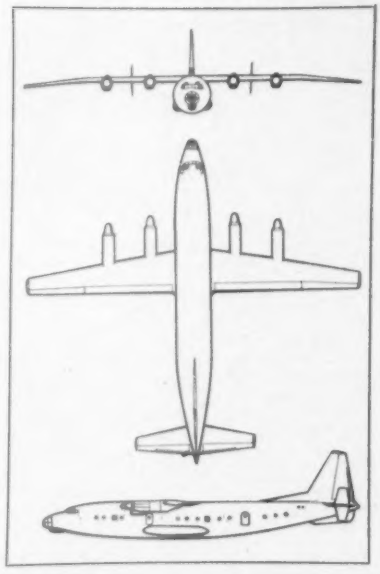
The Antonov An-10A

DEVELOPED in parallel with the Il-18, and to have a generally similar performance, the An-10A went into regular service with Aeroflot on July 22 between Moscow and Simferopol, in the Crimea, and Simferopol and Kiev. This was about 2½ years after the first flight, and there is evidence that some difficulties were experienced with lateral stability. Modifications include the fitting of end-plate fins on the tailplane and introducing anhedral on the outer wing panels. The design of the engine nacelle has also been modified in detail.

Earlier this year, the An-10A was being used for freight services in the Ukraine, and it has demonstrated its ability to land in small, unprepared fields at collective farms to pick up fruit and vegetables. Ability to operate from grass runways was one of the primary design aims, and it is likely that regular freight operations will be undertaken by the An-10A. Reference has also been made recently to a military version with rear loading doors.

Like the Il-18, the An-10 prototypes had Kuznetsov engines, but the Ivchenko AI-20 has now been standardized in the An-10A. A version with 10 ft. extra fuselage length, the An-16, has also been mentioned and would seat 130.





Dimensions
Span: 124 ft. 8 in.
Overall length: 121 ft. 4 in.
Overall height: 32 ft. 1 in.
Gross wing area: 1,293 sq. ft.
Sweepback: Nil on main spar.
Internal cabin dimensions:
Max. height: 108 in.
Max. usable volume (ex. flight deck): 7,840 cu. ft.

Accommodation
Normal first-class: 84 (5 abreast)
Normal tourist: 101 (6 abreast)
Max. coach: 130 (6 abreast)
Volume of freight and baggage holds: 1,483 cu. ft.

Powerplants
Four Ivchenko AI-20 turboprops.
Take-off power each (I.S.A., s.l.): 4,000 e.h.p.
Four-blade, 14.8 ft. diameter reversing propellers.

Weights and Loadings
Total fuel: 22,600 lb.
Mfrs. max. payload: 32,000 lb.
Max. take-off: 121,500 lb.
Wing loading (max. t-o. wt.): 88 lb./sq. ft.
Power loading (max. t-o. wt.): 7.2 lb./e.h.p.

Performance
Typical cruising speed (I.S.A.): 325 knots (at 26,000 ft.).
Take-off run: 2,130–2,300 ft.
Landing run: 1,640 ft.
Range (take-off to landing), still air, 1-hr. fuel reserve, I.S.A., max. fuel (2,800 Imp. gal.): 1,850 naut. mi. with 18,600 lb.
Range (take-off to landing) still air, 1-hr. fuel reserve, I.S.A., with max. payload: 1,980 naut. mi.

Structure: Two-spar wing in five sections including centre section through fuselage. Fuel tanks in wings. Circular-section monocoque fuselage.

Undercarriage: Four-wheel bogie main units, retract upwards into fuselage-side housings. Twin-wheel steerable nose-wheel.

Flaps: Double-slotted type, in two portions on each wing.

Flying Controls: Fully manual system with aerodynamically balanced ailerons, elevators and rudder.

Systems: Duplicated 2,100 p.s.i. hydraulic system for u/c, brakes, flaps, nose-wheel steering and windscreen wipers, with manual system for ground use with engines stopped. Cabin pressurization 7.1 p.s.i. by compressor-bled air. Electro-thermal de-icing of wing, tailplane, fin, propellers, intakes and windscreen.

The Ilyushin Il-18

THE Il-18 became the first Soviet turbo-prop transport to go into regular passenger service on April 20, 1959, on non-stop services from Moscow to Adler (1,050 miles) and Alma Ata (2,200 miles). Services to Leningrad, Sverdlovsk, Baku and Tashkent have been inaugurated since. The first flight was made at least two years earlier, so the time taken to test and develop the Il-18 is comparable with Western standards. For evaluation trials, 10 Il-18s were fitted with Kuznetsov NK-4 engines and 10 with Ivchenko AI-20s of similar power; the latter engine has now been standardized in production aircraft. At least 50 Il-18s are believed to be in service with Aeroflot, entirely on internal services.

The Il-18 is flown by a crew of four including two pilots, radio operator and navigator, with a jump seat for a flight engineer. The standard of cockpit layout and instrumentation, cabin furnishing and finish in general have impressed Western observers who have seen the Il-18 in Russia and at the Paris Aero Show. It is almost certainly the best of the Soviet turbine transports in terms of comfort and economy, and is likely to be pushed for export as soon as Aeroflot's initial demands have been met from the principal production unit at Vnukovo, near Moscow. An Il-18 has already been used for a prestige-boosting mission to Iraq.

Dimensions
Span: 122 ft. 8 in.
Overall length: 117 ft. 0 in.
Overall height: 33 ft. 5 in.
Gross wing area: 1,507 sq. ft.
Sweepback: Nil on main spar.
Internal cabin dimensions:
Length (ex. flight deck): 92 ft. 0 in.
Max. height: 78 in.
Max. usable volume (inc. flight deck): 8,830 cu. ft.

Accommodation
Normal mixed class, 65+15 (5 abreast).
Normal tourist: 100 (5 abreast).
Volume of freight and baggage holds: 1,250 cu. ft.

Powerplants
Four Ivchenko AI-20 turboprops.
Take-off power each (I.S.A., s.l.): 4,000 e.h.p.
AB-68B four-blade reversing propellers, 13.7-ft. diameter.

Weights and Loadings
Empty: 61,730 lb.
Total fuel: 42,770 lb.
Mfs. max. payload: 30,900 lb.
Max. take-off: 127,870 lb.
Wing loading (max. t-o. wt.): 84.9 lb./sq. ft.
Power loading (max. t-o. wt.): 7.93 lb./e.h.p.

Performance
Typical cruising speed (I.S.A.): 330 knots (at 26,250 ft.).
Take-off distance to 50 ft.: 3,900 ft.
Landing distance from 50 ft.: 3,800 ft.
Range (take-off to landing), still air, 1½ hr. fuel reserve, I.S.A., max. fuel (5,280 Imp. gal.): 2,700 naut. mi.
Range (take-off to landing), still air, 1½ hr. fuel reserve, I.S.A., with max. payload: 1,615 naut. mi.

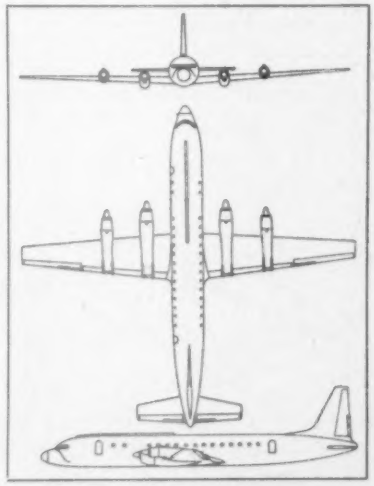
Structure: Three-spar main wing section, 72-ft. span, and two-spar extension planes. Integral tanks between spars in outer planes, bag tanks in centre section. Circular-section monocoque fuselage.

Undercarriage: Four-wheel bogie main units, backward retracting into inboard nacelles, and twin-wheel steerable nose-wheel.

Flaps: Single-slotted in one piece on each wing.

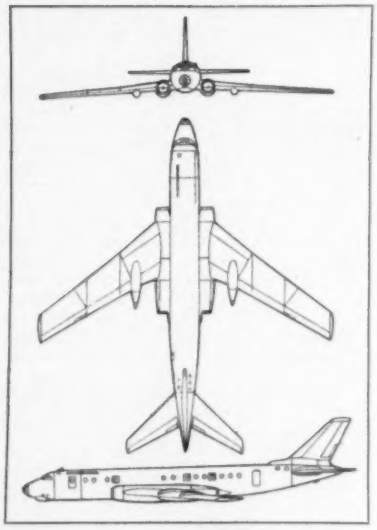
Flying Controls: Aerodynamically balanced manual ailerons, elevators and rudder; trim tabs on elevator and rudder, spring tab on rudder only.

Systems: 3,000 p.s.i. hydraulic system with two pumps and two 2,100 p.s.i. stand-by nitrogen-charged accumulators, for u/c, brakes, flaps, nose-wheel steering and windscreen wipers. Eight 12-kVA. engine-driven alternators generating at 115V.; starter-generators provide 28V. DC and batteries supply 24V. DC. Cabin pressurization 7.1 p.s.i. by compressor-bled air. Electro-thermal de-icing of wing, fin, tailplane, propellers, spinners, intakes and windscreen.



Commercial Aircraft . . . .

The Tupolev Tu-104



AEROFLOT has now been operating the Tu-104 for just over three years in regular scheduled service (since September 15, 1956). Between 100 and 150 are believed to be in service, in three variants. The original Tu-104s seat 50 in their distinctive "Victorian drawing-room"-style cabin; they are now restricted to a few domestic routes in the U.S.S.R. Numerically the most important is the Tu-104A, which seats 70 in rather less ornate style; this is used by Aeroflot on at least 12 international routes and a number of domestic services.

Third version is the Tu-104B, with a four-foot fuselage stretch, which seats 100, five-abreast, in a high-density interior styled in keeping with contemporary Western practice. The Tu-104B was put into service on the Moscow-Leningrad service in the spring of this year and now operates four round trips a day at 85% of the rail fare.

All models of the Tu-104 have Mikulin AM-3 engines, but those in the "B" are an improved variant with reduced s.f.c. Inter-overhaul period of these engines has recently been increased to 1,000 hr. from the 300-hr. life at which they started in operation.

An outline of the Tu-104A performance and engineering details is given here. Some interesting record flights have also been made by this aircraft. In September, 1957, a Tu-104A lifted a 44,213-lb. payload (20 tonnes) to 36,814 ft., and carried a 22,046-lb. payload (10 tonnes) over a 538-naut.-mile circuit at 524 knots. Last August, a Tu-104B lifted a 33,069-lb. payload to 21,325 ft., and flew with this payload over a 538-naut.-mile circuit at 548 knots.

Dimensions
Span: 114 ft. 10 in.
Overall length: 121 ft. 4½ in. (Tu-104B, 125 ft.).
Overall height: 39 ft. 4½ in.
Gross wing area: 1,825 sq. ft.
Sweepback: 35° on quarter-chord line.
Internal cabin dimensions:
Max. width: 126 in.

Accommodation
Normal (Tu-104): 50 (4 abreast).
Normal (Tu-104A): 70 (4 and 5 abreast).
Normal (Tu-104B): 100 (5 abreast).

Powerplants
Two Mikulin AM-3 (RD-3).
Take-off power each (I.S.A., s.l.): 19,180 lb. at 4,700 r.p.m.

Weights and Loadings
Total fuel: 60,000 lb.
Mfrs. max. payload: 19,500 lb.
Max. take-off: 164,250 lb.
Max. landing: 141,000 lb.
Wing loading (max. t.-o. wt.): 90 lb./sq. ft.
Wing loading (max. landing wt.): 77 lb./sq. ft.
Power loading (max. t.-o. wt.): 4.2 lb./lb.s.t.

Design Criteria
Max. coefficient of lift: 1.85.
Design limits: Mne=0.95.

Performance
Recommended cont. cruising speed (I.S.A.): 440 knots.
Approach speed (at max. landing wt.): 144 knots.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (7,470 Imp. gal.): 2,430 naut. mi.

Structure: Two-spar wing in two main units joined by a fuselage-width centre section. Circular-section monocoque fuselage.

Undercarriage: Four-wheel bogie main units, retracting up and back into wing nacelles; twin-wheel steerable nose-wheel. Triple cluster braking parachute fitted.

Flaps: Fowler-type in two portions on each wing.

Air brakes: None.

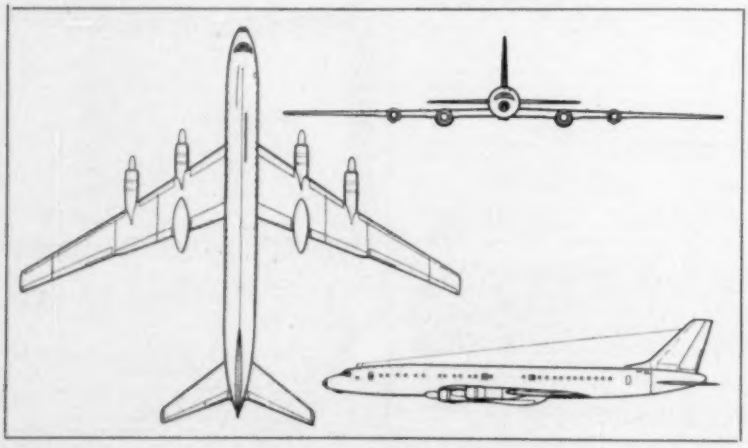
Flying Controls: Fully manual ailerons, elevator and rudder.

Systems: Thermal de-icing of wing leading edge by engine-bleed air. Cabin pressurization 7.2 p.s.i.

Data estimated or deduced.

The Tupolev Tu-114

LARGEST transport aeroplane in the World, the Tu-114, is believed to be on the point of entering service with Aeroflot, just two years after it was first revealed in the Soviet Press. First flights were made towards the end of 1957 and for a year or so little more was heard of this 200-ton giant. Then, in June of this year, the same prototype that had originally been illustrated turned up at the Paris Aero Show for its first foreign demonstration and, later in the same month, this same aircraft took the Soviet First Deputy Premier, Mr. Kozlov, to New York non-stop from Moscow.



It is not known how many Tu-114s have been built. No obvious modifications have been made since the aircraft first appeared, but observers at Paris did note some apparent fatigue cracks around the area of the engine exhausts. The engines are Kuznetsov NK-12Ms, believed to be derated from 12,000 s.h.p. to about 10,000 s.h.p. each.

The Tu-114 provides for up to 220 passengers, but on very long-range international flights is likely to carry only 120. The prototype at Paris had 170 seats, divided among a variety of compartments. Immediately aft of the front entrance lobby was a 42-seat cabin, with triple seat units each side of the aisle, and behind this a 48-seat restaurant in which, it appears, passengers are fed in relays. To the rear of the restaurant, and over the wing torsion box, was the galley, connected by two service lifts to a kitchen below floor-level and behind the torsion box. Aft again were four Pullman compartments, two each side and each containing six seats and three fold-down bunks. The rearmost compartment contained 56 seats.

As is widely known, the Tu-114 was based on the wing of the Tu-20 (Bear) bomber, with a completely new fuselage of 20,120 cu. ft. capacity (including 2,470 cu. ft. in underfloor freight holds). In May, 1958, another variant, the Tu-114D, appeared and seems to be a direct transport conversion of the Tu-20 with the same size of fuselage.

Few details of the Tu-114 have been made public. The data which follow have been attributed to Russian sources; although apparently credible, they should be treated with reserve. The span is approximately 177 ft.; length, 154 ft. 11 in.; and gross wing area, 3,000 sq. ft. The take-off weight is about 400,000 lb., including 176,370 lb. of fuel, and the maximum payload is likely to be about 45,000 lb. Wing-loading works out at 137.4 lb./sq. ft. Take-off distance (unqualified) is reported to be 9,350 ft., and landing distance, 8,695 ft.

Indicative of the Tu-114s performance are some of its known flights, such as Moscow-New York in 11 hr. 6 min.; New York-Moscow in 9 hr. 48 min. (467 m.p.h). Moscow-Paris in 4 hours and Moscow-Khabarovsk in 8 hr. 45 min. (496.8 m.p.h.).

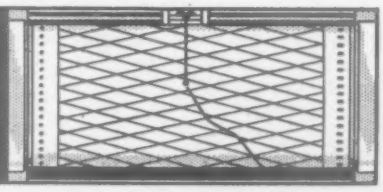
working pilot

The IFALPA delegate speaking on point source aids to the ICAO Special Meeting, Montreal, February 1959

. . . . "**It is a most unfortunate time to have to be fiddling with a receiver.** In order to tune in this type of station, you must switch off all of your other communications or else you will never pick up the Identification. One man in the cockpit is completely concerned with just one thing: tuning in the station – pressing his hands against his ears until he *can* identify it. The other man takes over the entire communications guard; continuously receiving clearances stepping the ship down, and also slowing it down; at the same time he is also operating a check list; this calls for conversation between himself and the other pilot if he can finish with his station identification. It is a very poor time to be distracted and pre-occupied with tuning a facility . . . there are eight holding stacks and of these six are non-directional beacons and the other two are intersections of radials from VORs. Holding on an intersection of two radials, you will be in a pattern something like this – one minute on this leg, a one minute turn, one minute on this leg, another minute turn and you are back where you started. On your Symbolic Display you centre the needle indicating the VOR radial from the left side; the VOR on the other side has a needle that is off-set, and as you approach the intersection, the needle on the other one will come into the centre—only at that one instant do you know exactly where you are. You then punch a stop watch and start a turn, using your directional Gyro and Turn Indicator—incidentally, you must hold your altitude with considerable precision because there are people above and below you in the stack. As soon as you leave this point both needles will be at various positions on the face of the dials and extremely difficult to interpret. As you come back into your pattern, the needle on the left should centre itself. If it does not you have wind drift, and you have a minute in which to correct it and bring it back into the centre. **'IS PICTORIAL PRESENTATION DESIRABLE?'** I would say that it most definitely is. There is only one instant in this four minute pattern when you know exactly where you are, and that is only if within that minute you have been able to re-align yourself". . .

. . . but you always know where you are with

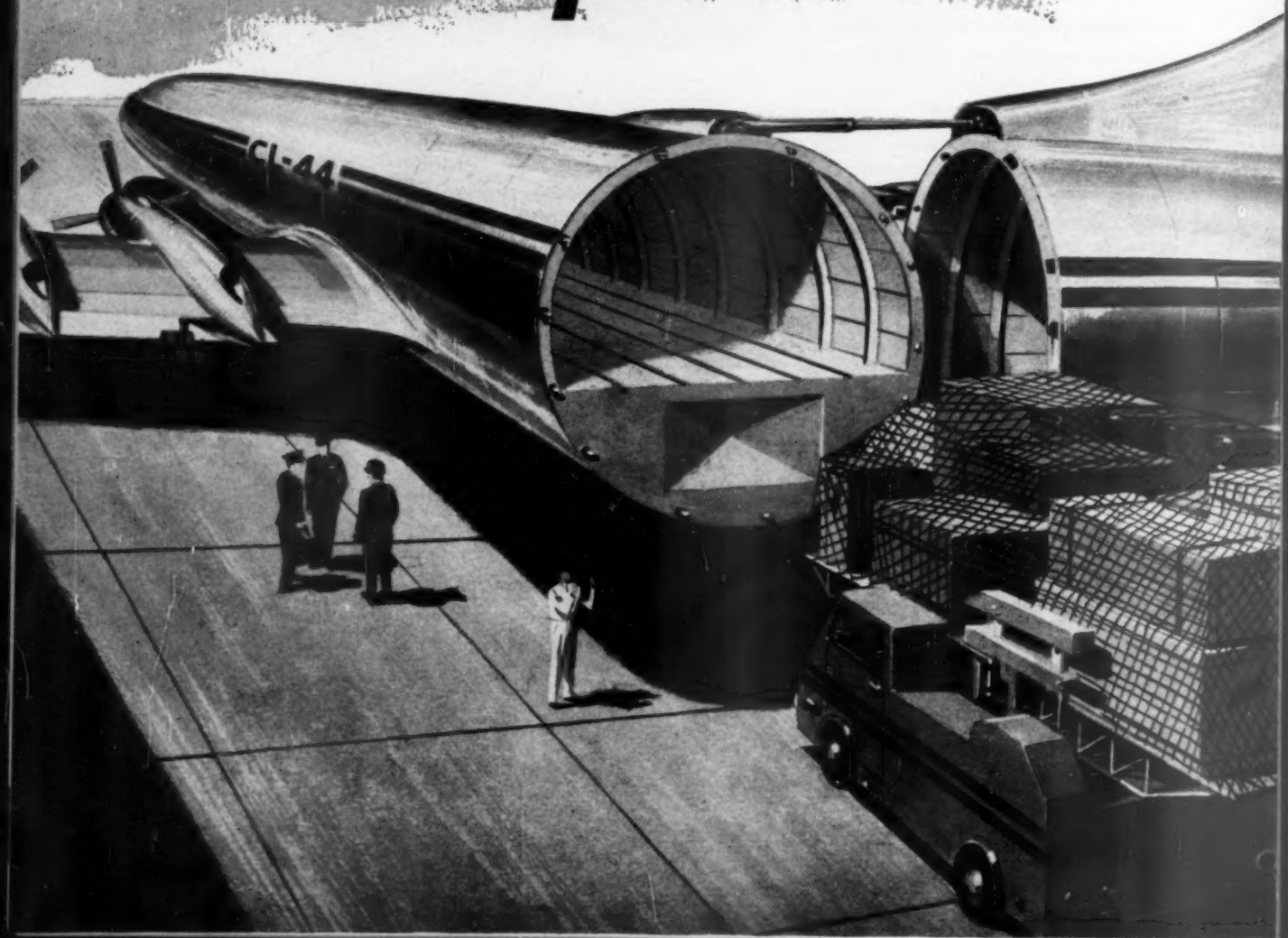
THE DECCA NAVIGATOR



THE DECCA NAVIGATOR
COMPANY LIMITED
LONDON

THE NAVIGATION SYSTEM FOR THE JET AGE

The swing-tail Air Freighter that *revolutionizes* the air cargo industry



CANADAIR JET-PROP CL-44

...a truly capable all-cargo aircraft

The CL-44 is an uncompromised aircraft that has been designed specifically to meet the immediate requirements for an aircraft that will significantly lower the cost of air cargo movement. In terms of volume, payload, speed, range and costs it will provide an unparalleled service to business and industry that will trigger an unprecedented increase in air freight volume.

The characteristics of this long-range all-cargo aircraft are unique and differ importantly from the characteristics of an essentially passenger-configured or military-configured airplane that has been adapted to commercial cargo capabilities.

The CL-44 provides

A turbo-prop propulsion system, which in comparison with turbo-fan and turbo-jet, offers the most efficient combination of payload and speed for optimum economy.

Direct operating costs of less than 4¢ a ton mile, and a break-even load factor as low as 28%.

Mechanical loading facilities and swing-tail that reduce ground time, manpower and costs, and increase utilization.

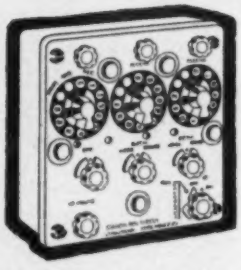
In 1961, more than a year ahead of any other long-range turbine powered cargo aircraft, fleets of CL-44s will go into service with the world's largest air cargo carriers.

CANADAIR
LIMITED, MONTREAL
the Canadian Subsidiary of
GENERAL DYNAMICS CORPORATION

Your request for detailed information on the Canadair CL-44 will receive our immediate attention: contact our European representative: J. H. Davis, Princes House, 190 Piccadilly, London, W.1.

CA59-CL44-2

80% of British civil aircraft use ULTRA communication control equipment...



Ultra Communication Control System UA56 now in use in all BOAC's Comet IV aircraft.

Ultra Communication Control Equipment, used in 80% of British civil aircraft, has won such a high reputation for performance and reliability that further development might well be considered superfluous. To accept this view would be entirely alien to the spirit of progress and enterprise that inspires the whole Ultra organisation. Newly developed Ultra Communication Control Systems now use transistor and printed circuit techniques, providing improved selection facilities together with lighter, more compact and more robust units. On the score of reliability, the new systems certainly equal the old, and are designed to surpass them. Full details will gladly be sent on request.

ULTRA

ULTRA ELECTRIC LIMITED
SPECIAL PRODUCTS DIVISION
WESTERN AVENUE · LONDON W.3 · Telephone: ACOrn 3434

AIRCRAFT CONTROLS & RADIO EQUIPMENT · RADIO RESCUE BEACONS · RADAR SIMULATORS
COMPUTER EQUIPMENT & ACCESSORIES · ELECTRIC SERVO SYSTEMS

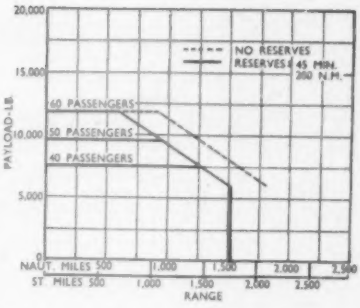
Commercial Aircraft . . . .

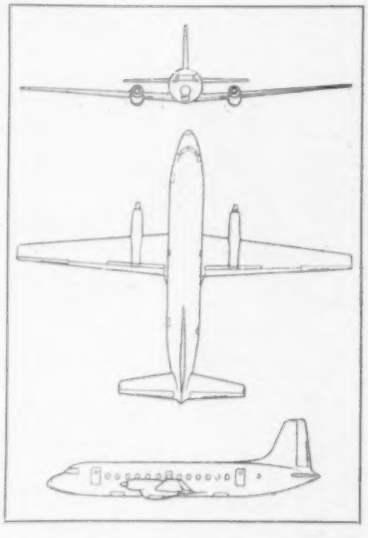
The Nippon YS-11

ALL six major Japanese aircraft design companies are represented in the Transport Aircraft Design Research Association (Y.S.K.K.) which was set up in April, 1957, to initiate the first Japanese post-war transport aircraft project. After a number of projects had been considered, this committee chose to produce an aeroplane designed to suit Japan's internal air routes. The YS-11 is the result.

With two 2,660 e.h.p. Rolls-Royce Darts, the YS-11 is the largest and heaviest of the several twin-Dart feederliners now on offer to the airlines. Its size was dictated by the requirement to carry up to 60 passengers—which it can do at a direct cost of 1.2d./seat-mile (S.B.A.C. method) over a 580 naut.-mile sector with a 3,000-hr. annual utilization.

To produce the YS-11, a new company was formed in July, 1958, with the title of Japan Transport Manufacturing Co. (N.R.S.K.). The largest shareholder is the Japanese Government, with smaller shares held by the six manufacturers—Shin Meiwa, Shin Mitsubishi, Fuji, Kawasaki, Nippon Hikoki and Showa Hikoki. The Transport Manufacturing Co. is at present building four prototypes, the first to fly in mid-1961.





Dimensions
- Span: 105 ft. 0 in.
- Overall length: 86 ft. 11 in.
- Overall height: 29 ft. 2 in.
- Gross wing area: 1,022 sq. ft.
- Sweepback: Nil.
- Internal cabin dimensions:
  - Length (ex. flight deck): 57 ft. 6 in.
  - Max. width: 129 in.
  - Max. height: 84 in.

Accommodation
- Normal tourist: 60 (5 abreast).
- Max. coach: 65 (5 abreast).
- Volume of freight and baggage holds: 286 cu. ft. (2).

Powerplants
- Two Rolls-Royce Dart R.Da.10.
- Take-off power each (I.S.A., s.l.): 2,660 e.h.p. at 15,000 r.p.m.
- Rotol four-blade e.s., f.f. propellers, 14 ft. diameter.

Weights and Loadings
- Basic operational: 31,220 lb.
- Total fuel: 6,400 lb.
- Mfrs. max. payload: 11,900 lb.
- Max. take-off: 49,600 lb.
- Wing loading (max. t.-o. wt.): 48.4 lb./sq. ft.
- Power loading (max. t.-o. wt.): 9.3 lb./e.h.p.

Performance
- Recommended cont. cruising speed (I.S.A.): 265 knots (at 20,000 ft.); power (per engine): 13,800 r.p.m.
- Take-off distance (I.C.A.O., at max. t.-o. wt.): I.S.A. at sea level: 3,930 ft.
- Range (take-off to landing), still air, reserves, I.S.A., max. fuel (1,540 Imp. gal): 1,750 naut. mi. with 6,615 lb. payload at 265 knots (mean) at 20,000 ft. (mean).
- Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 910 naut. mi.

Structure: Circular section monocoque fuselage. Two-spar wing in two pieces, attaching to centre section integral with fuselage. Bag tanks in torsion box inboard of nacelles, integral tanks outboard.

Undercarriage: Twin-wheel main wheels, and single wheel nose-wheel, all forward-retracting. Hydraulic brakes.

Flaps: Double slotted in one piece each side. Lift dumpers in two pieces each side ahead of flaps on upper wing surface.

Flying Controls: Conventional all-manual control surfaces with tab assistance.

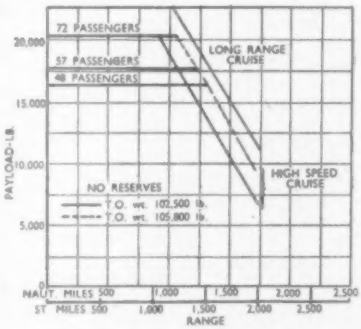
Systems: Cabin pressurized at 5 p.s.i. differential.

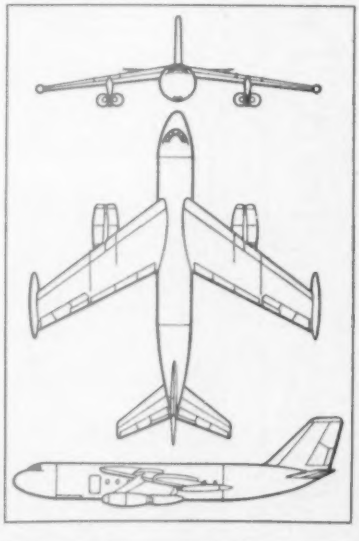
The Baade BB-152

EAST Germany's first original post-war aircraft, the BB-152, made its first flight on December 4, 1958, and although this prototype crashed at Dresden on March 4, full development and production is understood to be continuing. The information below is based on that made available at the Leipzig Fair.

The payload-range curve is for the BB-152/II, which is apparently the production version. Compared with the prototype production aircraft will have a radar nose and conventional tricycle (instead of bicycle) undercarriage with the main wheels retracting into fairings between the jet pipes.

The BB-152 was designed by Prof. Brunolf Baade, a former Junkers designer, and is built by VEB Flugzeugwerke, a State-owned factory in Dresden. The aircraft is of interest as one of the first attempts to produce a short-haul jet transport, carrying its maximum payload for little more than 1,000 naut. miles. The makers claim that its economy over these ranges is superior to that of the Caravelle. Delivery of production aircraft to the East German Lufthansa/Interflug is promised in 1960.





Dimensions
- Span: 88 ft. 7 in.
- Overall length: 103 ft. 0 in.
- Overall height: 29 ft. 6 in.
- Gross wing area: 1,485 sq. ft.
- Sweepback: 35° at 25% chord.
- Internal cabin dimensions:
  - Length (ex. flight deck): 56 ft. 0 in.
  - Max. width: 122 in.
  - Max. usable volume (ex. flight deck): 4,060 cu. ft.

Powerplants
- Four Pirna 014 turbojets.
- Take-off power each (I.S.A., s.l.): 6,950 lb.

Accommodation
- Normal first-class: 48 (4 abreast).
- Normal tourist: 57 (5 abreast).
- Max. coach: 72 (5 abreast).
- Volume of freight and baggage hold: 477 cu. ft. (1).

Weights and Loadings
- Basic operational: 62,655 lb.
- Total fuel: 27,226 lb.
- Mfrs. max. payload: 20,300 lb.
- Max. take-off: 105,800 lb.
- Max. landing: 89,287 lb.
- Wing loading (max. t.-o. wt.): 69.9 lb./sq. ft.
- Wing loading (max. landing wt.): 59.4 lb./sq. ft.
- Power loading (max. t.-o. wt.): 3.8 lb./lb.s.t.

Performance
- Recommended cont. cruising speed (I.S.A.): 432 knots (at 36,000 ft. and 92,600 lb.); power (per engine): 85% max.
- Landing speed (at 77,160 lb.): 107 knots.
- Take-off distance to 35 ft. (four engines): At I.S.A. at sea level: 4,315 ft.
- Landing distance from 50 ft. (unfactored, 77,160 lb. wt.): 4,590 ft.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel: 1,700 naut. mi. with 9,900 lb. payload.
- Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 1,080 naut. mi.

Commercial Aircraft . . . .

Piston-engined Transport Aircraft Data

Aircraft	Dimensions									Accommodation				Weights						Loadings		
	Span	Length O.A.	Height O.A.	Gross wing area	Internal cabin					First-class	Tourist	Coach	Total freight hold volume†	Basic op.	Total fuel	Mfrs. max. payload	Max. take-off	Max. landing	Max. zero fuel	Wing loading (t.-o. wt.)	Wing loading (land. wt.)	Power loading
					Length*	Max. height	Max. width	Floor area*	Usable volume*													
	ft. in.	ft. in.	ft. in.	sq. ft.	ft. in.	in.	in.	sq. ft.	cu. ft.				cu. ft.	lb.	lb.	lb.	lb.	lb.	lb.	lb./sq. ft.	lb./sq. ft.	lb./b.h.p.
Airspeed Elizabethan ..	115 0	82 0	18 3	1,200	35 3	84	120	290	2,200	47	49	60‡	300	39,720	7,000	12,250	55,000	52,000	52,000	45.8	43.3	10.5
Boeing Stratocruiser ..	141 3	110 4	38 3	1,720	78 6	86	123	500	3,500	61	75	102	900	85,290	46,000	21,500	147,000	129,000	113,900	85.5	75.0	10.5
Bristol 170/31	108 0	68 4	28 3½	1,487	31 8	79.5	96	252	2,360	32	40	44	343	27,358	8,438	13,800	44,000	44,000	41,640	29.6	29.6	11.0
Canadair Four (Argonaut) ..	117 6	93 5	27 6	1,457	42 6	84	118	416	2,620	36	40	55	698	48,844	23,227	18,000	80,200	72,000	68,000	55.1	46.7	11.4
Convair 240	91 9	74 8	26 11	817	33 5	79	106.5	259	1,651	40	—	—	420	29,526	6,000	9,561	41,790	39,800	38,000	51.1	49.7	8.7
Convair 340	105 4	79 2	28 2	920	36 7	79	106.5	283	1,817	44	—	—	514	31,609	10,380	13,391	47,000	46,500	45,000	51.1	50.6	9.8
Convair 440	105 4	81 6	28 2	920	36 7	79	106.5	283	1,817	44	—	52	514	33,314	10,380	12,836	49,700	47,650	47,000	54.1	51.8	9.9
D.H.114 Heron 2D ..	71 6	48 6	15 7	499	23 0	69	54	89	515	14	17	—	127	8,996	2,966	3,750	13,500	13,150	12,670	27.1	26.4	13.5
Douglas DC-3	95 0	64 0½	16 11½	987	30 0	79	92	191	1,245	28	32	—	160	17,720	4,800	5,382	25,200	24,400	—	25.5	24.7	10.5
Douglas DC-4§	117 6	93 11	27 7	1,463	55 5	92	118.5	495	3,775	44	60	82	567	39,327	21,600	21,373	73,000	63,500	60,700	49.9	43.0	12.6
Douglas DC-6	117 6	100 7	29 1	1,463	63 9	92	118.5	553	4,107	50	80	83	772	52,700	25,572	21,300	97,200	80,000	74,000	66.5	54.8	10.8
Douglas DC-6B	117 6	105 7	29 3	1,463	68 9	92	118.5	596	4,431	56	102	108	886	58,635	33,072	24,565	107,000	88,200	83,200	73.2	60.3	10.7
Douglas DC-7B	117 6	108 11	29 3	1,463	84 0	92	118.5	625	4,647	60	91	99	983	74,689	38,268	21,311	126,000	102,000	96,000	86.2	69.6	9.7
Douglas DC-7C	127 6	112 3	31 8	1,637	87 4	92	118.5	654	4,863	62	89	99	1,149	80,000	46,944	21,500	143,000	111,000	101,500	87.5	67.8	10.5
Hunting President	64 6	46 0	16 0	400	20 0	72	66	—	—	—	12	—	53	9,136	1,670	3,800	13,500	13,500	—	33.7	33.7	12.7
Lockheed L-749	123 0	95 2	22 5	1,650	64 9	79	128.5	561	3,000	57	69	—	434	65,074	34,338	20,276	107,000	89,500	86,464	65.0	54.2	10.7
Lockheed L-1049	123 0	113 7	24 9	1,650	83 2	79	128.5	744	4,875	64	81	—	680	74,073	34,338	19,335	120,000	98,500	93,500	72.7	59.7	10.7
Lockheed L-1049C	123 0	113 7	24 9	1,650	83 2	79	128.5	744	4,875	65	89	—	694	77,100	38,645	26,400	133,000	110,000	103,500	80.8	66.7	10.25
Lockheed L-1049G	123 0	113 7	24 9	1,650	83 2	79	128.5	744	4,875	65	89	—	694	79,237	38,645	24,293	137,500	113,000	103,500	83.4	68.5	10.6
Lockheed L-1049H	123 0	113 7	24 9	1,650	83 2	79	128.5	744	4,875	—	104	106	694	71,614	38,645	42,631	142,100	119,975	114,975	86.7	72.7	10.9
Lockheed L-1649	150 0	116 1½	23 5	1,850	83 1½	78	128.5	—	—	58	80	99	—	91,645	56,600	24,355	156,000	123,000	116,000	84.3	66.5	11.5
Nord 2502	110 3	72 0½	19 10½	1,089	32 4½	94.5	108	234	1,800	—	36	45	70	30,080	8,080	16,640	50,700	48,500	46,720	46.5	44.5	12.4
Scottish Twin Pioneer 2 ..	76 6	45 3	18 0	670	22 8	69	72	129	730	—	16	19	96	11,000	1,735	1,800	14,000	14,000	—	20.9	20.9	11.7
Scottish Twin Pioneer 3 ..	76 6	45 3	18 0	670	22 8	69	72	129	730	—	16	19	34	10,200	1,735	3,200	14,600	14,600	—	21.8	21.8	11.4
Vickers Viking 1B	89 3	62 10	19 6	882	39 3	80	95	249	1,665	24	27	—	250	24,000	5,400	7,120	34,000	33,250	—	38.0	37.0	10.0

* Excluding flight deck. † Outside cabin volume. ‡ Theoretical. § Weights for cargo version.

Aircraft	Power plant				Performance												
	No.	Type	T.O. Power (each)		Recommended cont. cruise					App-roach speed	Balanced field length			Landing distance from 50 ft.	Range (take-off to landing) no reserves					
															Max. fuel					Max. Payload
					Speed	Alt.	Weight	Con-sump-tion	Power per engine		I.S.A., s.l.	I.S.A.+ 15°C. s.l.	I.S.A. 5,000 ft.		Range	Payload	Speed	Alt.	Fuel	
			b.h.p.	r.p.m.	knots	ft.	lb.	Imp. gal./hr.	b.h.p.	knots	ft.	ft.	ft.	ft.	naut. mi.	lb.	knots	ft.	Imp. gal.	naut. mi.
Airspeed Elizabethan	2	Centaurus 661	2,625	2,700	209	15,000	49,500	150	1,200	105	6,050	6,860	6,560**	4,350	1,266	8,290	194	15,000	986	504
Boeing Stratocruiser	4	R-4360-TSB3-G	3,500	2,700	240	15,000	135,000	430	1,750	117	8,000	8,610	8,830	4,040	3,200*	12,000	216	15,000	6,390	2,400*
Bristol 170/31	2	Hercules 734	2,000	2,800	137	S.L.	44,000	110	1,000	94	2,600	3,100	4,100	2,280	1,400	8,204	137	S.L.	1,172	—
Canadair Four (Argonaut)	4	Merlin 626-1	1,760	3,000	217	17,000	69,000	224	950	100	5,140	—	5,630	5,040	3,440	9,064	193	10,000	3,226	2,385
Convair 240	2	R-2800-CA-18	2,400	2,800	235	16,000	40,000	154	1,100	102	5,090	5,300	—	3,930	896†	6,250	220	16,000	833	350†
Convair 340	2	R-2800-CB-16/17	2,400	2,800	235	16,000	46,000	168	1,200	120	3,880‡	4,180‡	—	4,240	1,680†	4,900	228	16,000	1,440	90†
Convair 440	2	R-2800-CB-16/17	2,500	2,800	235	16,000	48,000	168	1,200	121	5,700	6,000	—	4,040	1,680	5,900	230	16,000	1,440	245
D.H. 114 Heron 2D	4	Gipsy Queen 30 Mk. 2	250	2,500	159	8,000	13,000	42	165	81	3,570	3,870	5,150	2,065	1,540	1,320	159	8,000	412	500
Douglas DC-3	2	R-1830-92	1,200	2,700	163	10,000	25,200	73.5	600	79	4,050	4,400	—	1,980	1,780	2,075	155	9,350	663	173
Douglas DC-4	4	R-2000-SD13G	1,450	2,700	197	10,000	65,000	194	735	98	5,070	5,340	5,690	3,175	3,680	11,400	175	10,000	3,000	1,860
Douglas DC-6	4	R-2800-CB-16	2,400	2,800	285	22,400	80,000	352	1,200	102	5,150	5,420	6,580	2,840	3,420	17,700	222	15,000	3,550	2,900
Douglas DC-6B	4	R-2800-CB-17	2,500	2,800	274	22,400	90,000	352	1,200	108	6,150	6,475	6,830	3,100	4,110	14,065	230	15,000	4,590	2,610
Douglas DC-7B	4	Turbo-Compound DA4/EAI/EA4 ..	3,250	2,900	310	22,500	100,000	422	1,800	115	6,100	6,475	7,340	3,490	4,275	11,663	248	15,000	5,310	2,850
Douglas DC-7C	4	Turbo-Compound EAI/EA4 ..	3,400	2,900	301	21,600	110,000	422	1,800	110	6,360	6,680	7,390	3,320	4,900	15,310	238	15,000	6,515	4,025
Hunting President	2	Leonides 504/5A	540	3,000	143	8,000	13,000	30	245	—	3,800	—	—	2,525	1,010	2,500	143	8,000	238	993
Lockheed L-749	4	R-3350-C18-BD1	2,500	2,800	264	20,000	104,000	380	1,383	122	4,850	5,100	6,920	4,670	3,650§	7,500	204	10,000	4,770	2,645§
Lockheed L-1049	4	R-3350-C18-CB1	2,800	2,900	262	20,000	109,500	408	1,475	123	5,420	5,852	7,200	4,330	3,625*	7,100	210	10,000	4,770	2,270*
Lockheed L-1049C	4	R-3350-C18-DA1	3,250	2,900	273	20,000	129,600	412	1,775	123	5,120	5,606	7,150	5,120	3,100*	17,600	214	10,000	5,370	3,100*
Lockheed L-1049G	4	R-3350-C18-EA3/EA6	3,400	2,900	270	20,000	131,000	460	1,925	125	5,800	6,340	7,800	5,270	3,000*	18,315	282	15,000	5,370	3,000*
Lockheed L-1049H	4	R-3350-C18-DA3/EA3/EA6 ..	3,400	2,900	270	20,000	130,800	460	1,925	125	6,510	7,077	7,550	5,600	3,010	29,500	233	15,000	5,370	1,640
Lockheed L-1649	4	Turbo-Compound EA-2	3,400	2,900	297	22,600	123,000	417	1,800	—	6,500	—	—	3,600	6,365	7,755	222	15,000	7,993	4,900
Nord 2502	2	Hercules 758/Marboré II	2,040‖	2,800	172	10,000	49,000	123	940	102	4,900	5,550	5,900	3,000	1,484	12,710	172	10,000	1,120	685
Scottish Twin Pioneer 2	2	R-1340-S3HI-G	600	2,250	106	5,000	—	36	300	73	3,603	4,088	—	1,500	670	1,000	106	5,000	247	380
Scottish Twin Pioneer 3	2	Leonides 531/8B	650	3,200	114	5,000	—	37	325	70	3,000	—	—	1,240	700	2,500	114	5,000	247	400
Vickers Viking 1B	2	Hercules 634	1,675	2,800	182	10,000	32,500	88	720	—	3,600	4,200	4,350	3,650	1,950	4,600	149	10,000	750	1,000

* With 5,500 lb. reserve fuel. † With 1,500 lb. reserve fuel. ‡ FAA field lengths. § With 4,400 lb. reserve fuel. ‖ Plus 880 lb.s.t. each from Marboré turbojets. ** I.S.A. at 2,000 ft.

SURVIVAL DEPENDS ON VERSATILITY IN DEFENCE AGAINST AIR ATTACK AS IN NATURE

The story of evolution is the story of success, or failure, in versatility. Those animals that could adapt themselves to changing conditions of life multiplied, flourished and survived. Those that were too set in their ways died out.

It is not only in Natural History that versatility – the ability to perform more than one function – is of critical importance. It is equally important in the field of defence against air attack. If we ever again have to defend ourselves against attack from the air, the one certain thing is that the pattern of attack would be chosen so as to make things as difficult as possible for the defence. The less flexible our methods of defence, the more easily they could be baffled.

VERSATILITY IN DEPLOYMENT

A vital weapon for defence against air attack is the guided missile. Missile systems can either be permanently sited on fixed concrete emplacements, or, like the English Electric Thunderbird, be made fully mobile, moved across country in standard military vehicles, and redeployed in a few hours.

The important thing is that the second category – and this means Thunderbird – can also be used in a static role. It can stay put on a chosen site for as long as that site continues to be the most suitable one. It doesn't have to be concreted in: and this saves money and man hours.

But if the unexpected happens – and in war it always does – Thunderbird can be away and in action again to meet a new threat overnight. It is operationally flexible. Now in service with the Army, its inherent mobility allows for quick changes in plan, easy resiting of defence and provides the versatility which is of ever increasing importance to present and future air defence.

EVOLUTION CONTINUES

An even more advanced version has been under development for some time and is well under way. Amongst other improvements, Thunderbird's successor will provide longer range and increased low-level capability whilst still retaining its full mobility and air-transportability. Evolution, in fact, is still going on – an evolution which, as in nature, will still further increase the versatility of the Thunderbird Weapon system, upon which our survival may depend.

'ENGLISH ELECTRIC' THUNDERBIRD

ENGLISH ELECTRIC AVIATION LIMITED · *GUIDED WEAPONS DIVISION* · LUTON · STEVENAGE · WOOMERA

A MEMBER OF THE ENGLISH ELECTRIC AVIATION GROUP

GW 23

American Civil Airlines choose British Sparking Plugs

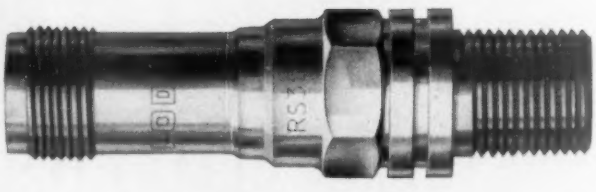
TWA *and* FLYING TIGERS

now fit

LODGE

AIRCRAFT SPARKING PLUGS

Lodge have once again proved the excellence of their products by obtaining considerable success with a new plug, the RS35R, which they have developed for the Curtiss Wright Turbo-Compound engine, the most powerful piston engine at present in civil use. Trans-World Airlines, one of America's largest airlines, and Flying Tigers, the leading freight carriers in America, have signed contracts for the exclusive use of the Lodge RS35R in their DC7 and Super Constellation fleets which are powered by the Curtiss Wright Compound engine. These contracts were obtained in the face of keen competition from the American sparking plug manufacturers. The RS35R plug gives reliability and stable performance under all engine operating conditions, and service of between 750 to 1,000 hours are obtained without removal from the engine. Such service is obtained by the use of platinum alloy electrodes and the Lodge exclusive "Sintox" alumina ceramic insulating material. Other famous airlines who use the Lodge RS35R in their Curtiss Wright Compound engines are Air France, B.O.A.C., Lufthansa, Qantas Empire Airways, Sabena, South African Airways, Swissair, and Trans-Canada Airlines.



LODGE · PLUGS LIMITED, RUGBY ENGLAND

Astronautics and Missiles

The Saturn Project

The multi-stage space booster pioneered by the U.S. Army Ballistic Missile Agency described by Kenneth Gatland

"THERE is no denying that the Russian successes in space have hit our prestige hard," said Mr. T. Keith Glennan, the NASA administrator, in a recent speech before the Economic Club of Detroit. "But total success without some failures is contrary to scientific experience. And this is part of the Russian space programme that goes unpublicized.

"The Soviets have managed to convince many, even in the relatively sophisticated Western nations, and certainly in the less industrially developed nations, that Russian achievements in space are the true measure of scientific and technological advancement and thus the measure of the strength of a culture. Achievements in space appear to have made more credible

Comparing models of the Saturn space-vehicle and Jupiter IRBM are left to right: Mr. Karl Heimburg, director of ABMA's Test Laboratory; Dr. Wernher von Braun, director of ABMA's Development Operations Division and Major General J. B. Medaris, Commanding General of the Army Ordnance Missile Command. At extreme right is a model of the ABMA static test stand which is being modified to accommodate the huge Saturn booster.

Soviet statements in other fields—economic, political and ideological.

"The Soviet propaganda drive is especially impressive to the people of nations with little industry or technology of their own," Glennan said. "Millions are taking the technological accomplishments the Russians publicize so well and effectively as models for their own ambitions. Not knowing fully how these advances were made, they reason that the Russian peasant hoisted himself by his bootstraps in less than a lifetime, lifting himself to technological peaks in all areas. Uncritically they wonder if other marginal people might not be well advised to step in quietly behind the Communist band-wagon in the hope of being swept on to Utopia, overnight, and practically painlessly.

"That, in essence," Glennan concluded, "is the international problem we face. To counter the spreading Communist influence that is based on Soviet space accomplishments, it is imperative that the United States pursue its own space programme actively, effectively, and with all the ingenuity we can muster."

Multiple Rocket Engines

One of America's big hopes for meeting Russia's challenge in space development is vested in the Saturn Project, the object of which is to provide by 1962-63 an efficient and reliable booster for lifting payloads of several tons into high orbit around the Earth and payloads of about a ton into deep space.

Originated in August, 1958, at the Army Ballistic Missile Agency, Huntsville, Alabama, under contract with the Advanced Research Projects Agency, the project has lately come under U.S.A.F. control. This was one outcome of the recent reorganization that has taken place in America, making the Air Force responsible for all space-boost vehicles.

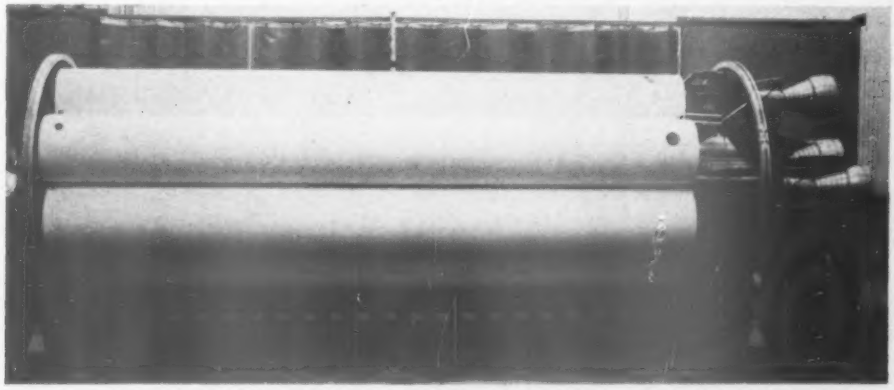
Initially, ARPA had authorized construction of one first-stage booster for static testing, plus four flight vehicles. The first of these, originally scheduled for early 1961, would use dummy upper stages while the third and fourth were to include a modified Titan first stage. Funds committed up to August of this year totalled $34 million.

The vehicle's first stage follows closely the design philosophy of Dr. Wernher von Braun, ABMA's technical director, who has insisted for some years that the key to early success with large space-vehicles lies in clustering a number of well-proven, reliable rocket engines.

Saturn's first stage will accordingly use a cluster of eight H-1 engines built from existing Jupiter and Thor engine components and using liquid oxygen and RP-1. These will produce a total static thrust of about 1.5 million lb., equivalent to 30 million h.p.

The engines themselves, being supplied by the Rocketdyne Division of North American Aviation, are considerably more compact than Jupiter and Thor engines of the same 150,000 lb. thrust rating. The first such engine was delivered to the Army Ordnance Missile Command on May 1, 1959.

Each of the eight H-1 engines comprising the Saturn cluster operates independently with its own gas generator and turbo-pump. Most of the modification work has been concerned

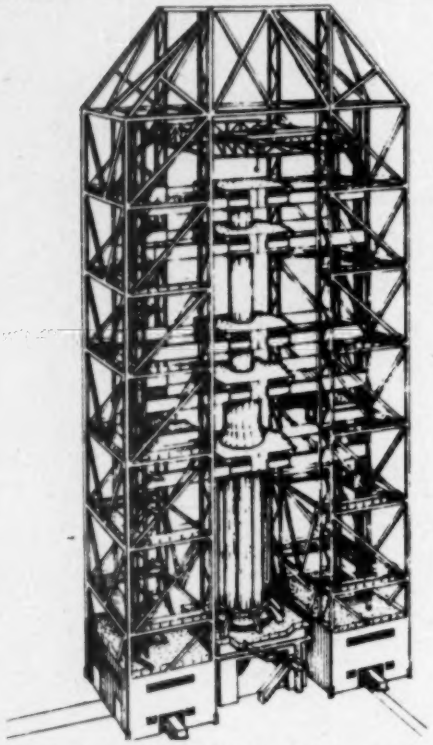


Side view of the 75-ft. long Saturn booster to quarter scale.

with the repackaging of components to achieve a compact grouping within the booster frame. For example, the turbo-pump is now slung side-saddle on the thrust chamber as contrasted with its former position on top of the chamber. Rocketdyne has stated that continual analysis of the static test firing reports on the 10-year development programme of the Redstone, Jupiter, Thor and Atlas engines has permitted the H-1 chamber to be designed on the basis of this experience, resulting in the elimination of trouble spots, and improvement in associated components.

The start sequence is the simplest of any yet provided in the family of liquid-propellent engines. Ignition is hypergolic (self-igniting), and safety devices have been built into the engine, one of which is to ensure that all eight engines of the cluster are functioning normally before the vehicle can be released.

Directional stability of the entire Saturn vehicle will be maintained by swivelling the four outer engines of the cluster. These engines, mounted on gimbals, will be moved by struts actuated by the guidance equipment. An all-inertial guidance system will automatically compensate for deviations resulting from loss of thrust should one of the first-stage boost engines fail.



Artist's impression of the 305-ft. self-propelled servicing gantry to be built at Cape Canaveral.

One possible configuration of the multi-stage Saturn vehicle would be the 1.5-million-lb. s.t. booster, a modified Titan first stage and a Centaur high-energy upper stage. This combination would have a total launching weight of about 580 tons, some 500 tons of which would comprise propellents. It would stand nearly 200 ft. high.

Other configurations are being studied, and a fourth stage, as yet unselected, may be added later for specific missions. It has been suggested unofficially that this might comprise the 6,000-lb.-s.t. storable liquid rocket being developed by the Jet Propulsion Laboratory.

The boost stage itself, approximately 75 ft. tall and 22 ft. maximum diameter, is being constructed of eight individual tanks of Redstone diameter clustered around a central tank of Jupiter diameter. Tanks of actual missiles have not been utilized, but diameters have been preserved to permit the use of existing tooling. An accompanying photograph shows the layout of the engines with respect to the tank cluster.

As plans stand at the time of writing, the first-stage cluster will be static tested on a special 175-ft. tower at ABMA. Flight tests will follow from the Atlantic missile range at Cape Canaveral, where a 305-ft. self-propelled servicing gantry will be constructed.

Objectives

Earlier this year, Mr. Roy Johnson, director of ARPA, stated that "the Saturn vehicle will be an extremely useful space workhorse, able to put up heavy, low-altitude, satellites, communication satellites, and deep space probes. We expect that it will also be able to carry a ton of instruments to a soft landing on the Moon."

Until quite recently, however, the project was being financed exclusively on its ability to orbit a communications satellite weighing several tons, 22,000 miles above our planet. According to Mr. Johnson, "this is important to us because at this distance it would orbit the Earth once every 24 hours. Since the Earth rotates about its axis in the same time interval, the satellite would remain stationary with respect to a fixed point along the Equator. Such a 24-hr. equatorial satellite will become an essential part of a World-wide military communications system."

Boost Recovery

The original intention of Dr. von Braun and his colleagues at ABMA was that Saturn should become a general workhorse of the Space-Age, and that its production might exceed one-hundred. To this end, special attention has been given to the economics of the project. The aim is to obtain high reliability in operation by using proven components, and also to attempt recovery of the first-stage booster.

A special system employing parachutes and retro-rockets is being developed by the Cook Electric Company to permit the booster to be recovered for post-flight inspection and possible further use. It is pointed out, however, that only if production quantities were high would booster recovery pay. ABMA would then like to feel that the whole boost unit could be re-used after stripping down and servicing, but if the unit connot be retrieved as a serviceable entity, they would still consider it worth while to preserve the engines.

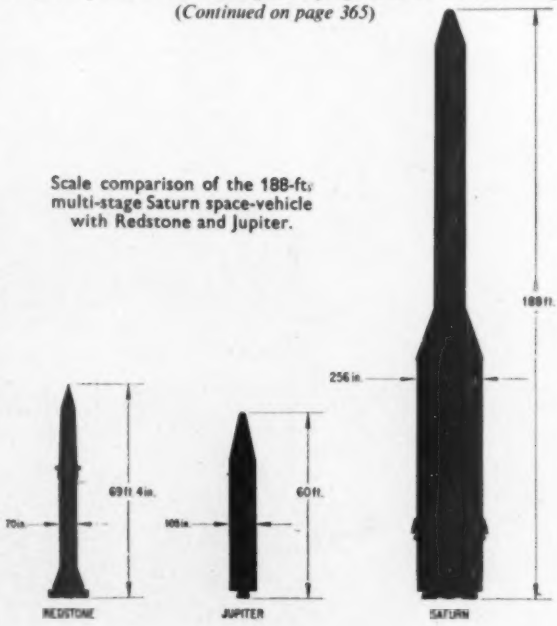
Equatorial Orbit

One difficulty of launching Saturn from Cape Canaveral into an equatorial orbit is that, having first entered a lower, preliminary orbit, the vehicle must change the plane of this orbit before undertaking the final manœuvre. Plane changes are costly in energy (and, consequently, payload), and require a particularly high standard of guidance control. But unless America invests in an equatorial launching site, these complications will have to be tolerated.

Other factors studied by ABMA concern the fate of a vehicle if one or more engines fail during an early stage of launching. It seems quite possible, they said, to programme a secondary emergency mission on tape, so that the vehicle automatically steers an alternative course after reaching a certain predefined point along the flight path.

Thus, it might realize a lower orbit, if the aim were a satellite, or, alternatively, it might be arranged to jettison payload canisters and fulfil the original mission. If failure occurred sufficiently late in the boost phase, propulsion of the remaining

(*Continued on page 365*)



Scale comparison of the 188-ft. multi-stage Saturn space-vehicle with Redstone and Jupiter.

THINK of a passenger . . .

not any specific important person, but a bread-and-butter, fare-paying, profitable airline passenger; on time . . . comfortable . . . ready to tell his friends about your airline and use it again.

Put him in a roomy, pressurized cabin. Add 46 regular fare-payers, or take on a mixed payload of passengers and freight. Sooth your source of revenue with the smoothness and reliability of two Rolls-Royce Dart jet-prop engines. Give him fast cruising with low landing speed and every mod. con. that means passenger-appeal. Add up the modern advantages: take away the false economy of an old piston-engined plodder that is only just earning its keep; and you'll show a handsome profit with the *passenger-appealing, low-cost*

HANDLEY PAGE **DART**

Herald

JET-PROP TRANSPORT

HANDLEY PAGE LIMITED · RADLETT · LONDON · READING

R.F.D. SINGLE SEAT LIFERAFT

COMPLETES DRAMATIC RESCUE OF TEST PILOT JOHN SQUIER

After ejecting from an English Electric Lightning fighter at 40,000 ft., test pilot John Squier parachuted into a heavy swell in the Irish Sea off the West coast of Scotland. 28 hours later he waded ashore having spent that time adrift in an R.F.D. Single Seat Liferaft.

The Liferaft that featured in this spectacular escape was an R.F.D. Mk. 3 Single Seat. This liferaft is fitted with an inflatable floor and canopy which protects the occupant from extremes of temperature. It was stowed in the Personal Survival Pack, attached to the pilot.

The Liferaft is gas-inflated in about 5 seconds, by pulling a release device. This R.F.D. Single Seat Liferaft is on general issue to current R.A.F. fighter aircraft. R.F.D. manufacture a full range of aeronautical liferafts from 1 single to 26-seat.

Safe with R·F·D

R.F.D COMPANY LIMITED
GODALMING · SURREY · ENGLAND
Tel.: Godalming 1441

(*Continued from page 364*)

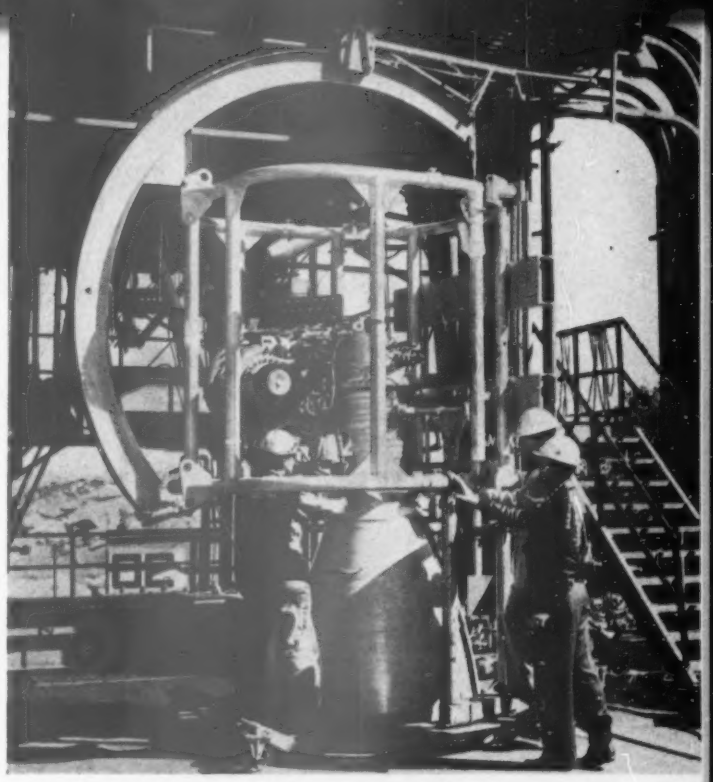
engines could be continued over a longer period when the loss of one, or possibly two chambers, would not be too severe.

The high reliability standards required for the Saturn booster should make it eminently suitable for launching manned space-vehicles and, indeed, it could play a part in the celebrated Dyna-Soar boost-glide project. If towards the end of the 1960s the stage has been reached of carrying men into orbit to perform space-station maintenance operations, it may well be that the Saturn booster will be produced in the large numbers envisaged.

Saturn's ability to launch payloads of a ton or more to the Moon will be particularly relevant following the recent Russian success with Moon-probes, and despite some recent doubts on the project's future, it will be strange if it is not heavily backed by the U.S.A.F.

The other boost project of interest to the United States is the still larger Nova, which is designed to use the new 1-1.5 million lb. s.t. single-chamber rocket engine being developed by Rocketdyne. Four or six of these huge engines will be used in the first stage of a four- or five-stage vehicle standing perhaps 260 ft. high. Estimates suggest that this vehicle could orbit a 150,000-lb. "space laboratory" at 300 miles, or alternatively could soft-land more than 19,900 lb. on the Moon.

The big problem in developing this space-leviathan is that before it can be put fully into operation, nuclear-energy may have been successfully applied to rocket propulsion. On the other hand, its designers point out that a nuclear rocket employed in the middle stage of this vehicle would greatly extend its performance. ABMA's opinion is that if nuclear propulsion arrives in the 1960s, it could just as easily be applied to the Saturn project, raising the performance of their booster to the level estimated for the all-chemical Nova.



One of the Rocketdyne H-1 rocket engines for Saturn's eight-engine cluster (nominal thrust rating 8 x 175,000 lb.).

A Tyre for Space

A WIRE tyre has been developed in the U.S. by the Goodyear Tire and Rubber Co. for high-speed aircraft and space vehicles such as the Dyna-Soar. These cannot use conventional equipment because of kinetic heating. This new tyre will stand temperatures between 1,000° and 2,000° F. both in flight and during landing; rubber tyres melt at much lower temperatures.

Made entirely of wire, the new tyre has load deflection characteristics similar to those of pneumatic units, but a higher rolling resistance. The tyre which has been tested by Goodyear is 14 in. in diameter and 4 in. wide; it weighs about 40 lb. In appearance it is similar to the circular wire brushes used with small power tools.

Aeromedical Aspects of Re-entry

IN getting a man back from space into the atmosphere, two physiological problems arise: how much heat can he stand, and how much deceleration? It now appears that the two are interdependent—the more of one, the less of the other.

Commander B. F. Burgess, U.S.N., describes in *Aerospace Medicine* (the new name of the former *Journal of Aviation Medicine*) how he subjected six pilots in a centrifuge to temperatures ranging from 75° to 160° F. at the Aviation Medical Acceleration Laboratory in Johnsville, Pennsylvania. They were already trained in centrifuge technique, so could be trusted to relax, and not falsify the result by contracting their abdominal muscles to produce more *g* tolerance.

Each "subject" sat in the gondola for 20 minutes to allow his skin to take up the ambient temperature, and then the centrifuge was accelerated in seven seconds up to the peak value of *g* for that particular trial, and the peak maintained for 15 seconds. This peak value was increased in each trial up to the point where he lost peripheral vision—that is, he could no longer see either of a pair of green lights which were flashed on at random on either side of a red light at which he was staring. Each pilot, when the *g*-level causing impairment of vision had been found, was then submitted to a four-minute run at 0.25 *g* less than this figure, in each case without untoward symptoms.

The results showed a big reduction of *g* tolerance between 100° F., where the reduction was 0.2 *g* and 110° F., where it was 0.6 *g*. Thereafter the reduction of tolerance proceeded less abruptly until it reached 1.0 *g* at 160° F., a temperature which was found to produce symptoms of impending heat exhaustion.

Even at air temperatures above 120° F. the temperature inside the subject's mouth was found to rise uncontrollably, "indicating the storage of heat in the body," as the author puts it. He also admits that the relative humidity of the air, which is known to influence human tolerance to heat, was uncontrolled in these trials, and was as high as 90% at the highest temperature used.

The original *g* tolerance of these pilots at normal temperatures is not given in the report, but only the amount of *g* by which it was reduced in heated air. However, in a centrifuge experiment a year earlier, the same author found the tolerance of four subjects to vary from 3.75 to 4.94 *g*, with a mean of 4.5 *g*, in the sitting position; though, as acceleration to maximum *g* was spread over 12½ seconds, they could withstand 0.5 *g* more than if it took only seven seconds as in the recent trials.

This earlier experiment was to test *g* tolerance under reduced oxygen concentration, and it was found that, at simulated altitudes of between 16,000 and 21,000 ft. the average tolerance of 4.5 *g* in normal air (21% oxygen) was reduced to 3.7 *g* in an oxygen concentration of 9.5%, which was the lowest the subjects could stand.—A.E.S.

Precision of Moon-probe Launches

EXTREME launching accuracies necessary for lunar probe vehicles were discussed by Mr. J. E. Allen, B.Sc.(Eng.), A.F.R.Ae.S., A.M.I.Mech.E., A.F.I.A.S., of the Avro Weapons Research Division, in a lecture to the R.Ae.S. graduates' and students' section on October 7. He quoted the accuracies necessary if a probe was to be guided during its launching phase only.

For a probe intended to hit the Moon the velocity error must be under 75 ft./sec.—in a total speed of about 36,500 ft./sec.—at final-stage burnout. This assumed that the injection angle (i.e., angle of the vehicle at final-stage burnout) was exactly correct. If the speed were correct, the acceptable angular error was only 0.05°.

The velocity requirements were even more stringent if the probe were to become a Moon satellite; permissible errors were either 4 ft./sec. in velocity, or 0.02° in the injection angle. If the vehicle were to pass round the Moon and return to a braking ellipse around the Earth, the accuracies were 1 ft./sec. on velocity or 0.001° in angle. Such accuracies were out of the question with current guidance systems and mid-course or terminal corrections to the trajectory would be needed.

Mr. Allen backed up his lecture with an orbit model showing the relative positions of the Earth, Moon and Sun during probe flights. He also showed a model of a projected five-stage vehicle for lunar landings; two of the stages would actually land on the Moon's surface. The launch weight was 700,000 lb., but the vehicle was intended to refuel at a space station in orbit around the Earth. Mid-course and terminal guidance would be necessary for the vehicle, which would use advanced propellents.

Lunik III and its Orbit

ONE aspect of the circumlunar journey of Lunik III which has earned the Russians high praise is the accuracy with which the launching was made. Not that all the early Soviet predictions were confirmed in practice, but they were close enough to show that guidance techniques have been developed to a very high standard.

How, then, was this latest firing achieved? A plausible theory of how the Russians arrived at the large, multi-stage, rockets necessary for launching the Lunik probes was given in THE AEROPLANE AND ASTRONAUTICS last week, when it was suggested that the basic vehicle was based on a first-generation Russian ICBM, the design of which was "frozen" before the appearance of light-weight, high-yield, thermonuclear warheads. Guidance accuracy is thought to be related to a radio-inertial system.

It is well known from the work of V. A. Egorov that much attention has been given in the Soviet Union since 1953 to computing a large number of possible Earth-Moon trajectories. In this, complications arise because the Moon's mass (and hence its gravitation) is not known within more than 0.3%, so that despite the accuracy with which a probe may be aimed for a close-pass, the Moon's perturbing influence cannot be precisely estimated.

Accurate Course-setting

Russia's success with Moon-probes appears to lie in the extreme accuracy with which both the injection angle and cut-off speed are controlled during the launching phase. It is possible that this depends on rigorously calculating the outgoing trajectory and committing this information to tape, which is then fed into the input of a fast digital computer at the ground base.

When the rocket is launched, several radar stations "lock-on" to the vehicle and automatically follow its path. Working together with apparatus aboard the rocket, they will determine its co-ordinates with a high degree of accuracy. The corresponding data, fed into the computer and matched with the taped information, will then detect any deviation from course and will compute, and automatically transmit, the necessary correcting radio commands. In the rocket's final stage the guidance receiver will then interpret these signals in the form of control functions to ensure that the rocket is steered along the prescribed path.

If this is, in fact, a correct deduction, it would seem that the same computing centre has been used to track the vehicle on the passive part of the trajectory. On October 7, the *Tass* news agency reported that "analysis of the elements of the orbit, carried out in the co-ordinating computing centre, shows that the automatic interplanetary station is continuing to move strictly on the set orbit."

At the same time, details were given of the probe's position relative to the Moon. "In passing the point of minimum distance from the Moon, the automatic interplanetary station, in circling the Moon, is continuing to move away from the Earth and the Moon. By 20.00 hrs. today the distance of the interplanetary station from the Moon was 78,750 miles and from the Earth 259,040 miles.

"The further movement of the automatic interplanetary station away from the Earth will continue, reaching a maximum distance equal to 291,964 miles on October 10. Later on, the station will begin to approach the Earth, and will pass it on October 18 in a north-south direction. Its shortest distance from the Earth's surface will be 25,000 miles.

"Data received by the ground telemetering stations about the period of transmission from the interplanetary station on October 6 confirmed that the instruments of scientific measurement, the system of temperature control and the system of power feeding continue to function normally."

Corrected Figures

In view of all the difficulties in establishing an orbit of this kind, the Russians were extremely bold in putting out so much information on the predicted orbit. The figure for the closest approach to the Moon, for example, was originally given as 6,250 miles, and it was also said that the vehicle would be approaching the Moon on the morning of October 7.

In fact, the Russians subsequently announced that the probe passed within 4,375 miles of the lunar surface on October 6. One might point out in discussing "discrepancies" that 1,875 miles is still a very small error over the lunar distance, though the difference in transit time is less easily explained.

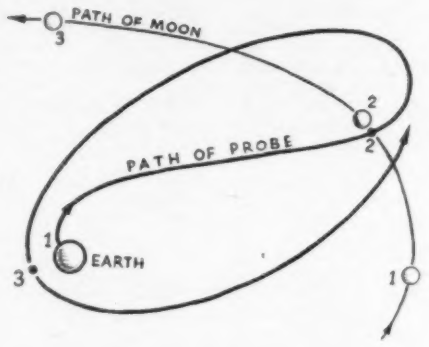


Diagram of Lunik III's orbit released in Moscow on October 6, two days after the launching. The figures indicate the position of the Moon relative to the probe at various stages: 1, at the time of launching; 2, at the time of closest approach to the Moon; and 3, at the closest approach to the Earth on the return swing (on or about October 18).

It seems evident now that there was no attempt to control the orbital path around the Moon by the use of a retro-rocket, but the probe seems to have swung out on a wider path than was anticipated. It seems that the speed was slightly up on theoretical estimates.

On October 9, *Tass* announced that "the interplanetary station is nearing the point of its maximum distance from the Earth. Its speed is falling continuously, and was 1,650 ft./sec. at 20.00 hrs. today.

"The interplanetary station will now move in a plane almost perpendicular to that of the lunar orbit. It will revolve round the Earth along an elongated ellipse with an apogee of 294,000 miles,* perigee of 25,000 miles, and rotation period of about 15 days." (Visitors to the Moscow Planetarium on October 5 were being told that the probe would have a period of 9½ days, which as it turned out was rather wide of the mark.)

Early uncertainty about the return path is reflected in the statement by Professor Dobronravov a few hours after the launching that he expected the probe to pass within about 1,250 miles of the Earth.

Photographing the Moon

One of the more publicized aspects of the experiment, the attempt to obtain a crude television picture of the far side of the Moon, is still an unknown quantity at the time of writing. The type of equipment used has not been revealed, but unless the vehicle embodies orientation devices enabling it to line up photographic apparatus directly with the Moon's sunlit face, it is likely to depend on elementary line scanning by means of a light sensitive cell fitted into the side of the probe, which would then be spin-stabilized. This method, used in the unsuccessful U.S.A.F. Pioneer lunar probes, suffers from the disadvantage that the scanning system will only obtain pictures at right angles to the probe's axis.

Little, too, has been revealed about the nature of the scientific instruments the probe is carrying, despite the fact that the aggregate payload is apparently heavier than that of any previous Moon probe. The final stage of the launching rocket, weighing more than 1½ tons, is said to contain 345 lb. of scientific equipment and the separated "interplanetary station" has a total weight of 614 lb.

The original announcement gave the orbital lifetime of Lunik III as "longer than Sputnik III," but figures now released make it certain to remain in space indefinitely. The station is equipped with both solar and chemical batteries, which should ensure a very long data-gathering mission, especially valuable for charting the Earth's radiation belts.

* The actual figure was subsequently given as 291,400 miles.

General Aviation News

DOWTY INTEGRATION. — From April 1, 1960, Dowty Equipment, Ltd., Rotol, Ltd., and British Messier, Ltd., are to be amalgamated into a single company. This new company will be known as Dowty Rotol, Ltd., and will have as joint managing directors, Mr. C. J. Luby and Mr. E. J. Nicholl.

JETSTAR TRAINER.—The U.S.A.F. is to use JetStars for bombardier/navigation training. For this rôle the JetStars will accommodate two pupils and an instructor.

SUPPLY ROUTE.—The R.N.Z.A.F. has surveyed and proved a new route from New Zealand to Singapore for its Bristol Freighter supply service to No. 41 Sqn., in Malaya. To be used if the Service wants to carry heavier-than-normal loads, the new route cuts out Indonesia and goes north from Australia through New Guinea, the Philippines and Borneo. Longest leg on the new route is 815 miles, compared with 1,050 on the old route, which allows the Freighters to carry 2,000 lb. more payload. But it is 250 miles (2 hr.) longer.

HONOURED.—Mr. H. "Jerry" Shaw was recently presented with a silver medal by the president of K.L.M. to commemorate the first commercial flight by K.L.M. between Croydon and Amsterdam—on May 17, 1920, by a D.H.16 with Mr. Shaw at the controls.

SUPER BROUSSARD.—Nord Aviation and Max Holste are to collaborate in the development and production of the M.H. 260 Super Broussard transport.

MACH 2.19.—On October 5, the Nord Griffon 02, with turbo-ramjet engine, reached Mach 2.19 (1,446 m.p.h.) at 49,200 ft.

GYRON JUNIOR ORDER.—Production orders have been received by de Havilland Engines for Gyron Junior engines to power the Blackburn NA.39 naval strike aircraft on order for the Royal Navy.

CONTROL EQUIPMENT.—A System Engineering Group has been set up by de Havilland Propellers, Ltd., to develop automatic control equipment for a wide range of non-aeronautical industries.

FAST AND LOW.—A Convair B-58 Hustler has flown 1,400 miles across America at low level and transonic speed to demonstrate its ability to attack "under-the-radar." After flying from Fort Worth to Edwards A.F.B. at heights never more than 500 ft. above ground level, the B-58 returned at high level without refuelling, in a total flight time of 4 hr. 3 min.

NA.39 TRIALS.—Carrier trials with Blackburn NA.39 low-level strike aircraft were due to begin on October 13. Forty catapult launchings and deck landings on H.M.S. Victorious are scheduled.

W.R.A.F. DIRECTOR.—Gp. Off. Anne Stevens, M.B.E., who becomes Director of the W.R.A.F. in March, 1960, in succession to Air Cdt. Dame Henrietta Barnett, D.B.E.

MISSILE DEFENCE.—As part of its anti-ICBM defence system the U.S. is to build an early-warning radar system in Puerto Rico. It will have a dish-shaped antenna 1,000 ft. in diameter and will cost about $2½ million. To be completed in about two years, the system will be able to locate an object measuring 1 cu. yd. at a distance of 20,000 miles. The equipment will also be used as a radio telescope.

SOVIET SPACE-MEN.—Men as well as dogs are being prepared for future space experiments, according to information released in Moscow on October 11. Pictures show men undergoing flight training "designed to build up resistance to the stresses of space-flight." The names of three trainees were given as Alexei Grachev, Alexei Blokonev, and Ivan Kachur.

NUCLEAR RAMJET. — A nuclear systems division has been founded by the Marquardt Corp.; it will be responsible for Project PLUTO, the nuclear ramjet development programme.

TURKISH IRBMs.—A U.S. report states that negotiations have been completed for the installation of an IRBM base in Turkey.

I.A.L. REORGANIZATION.—International Aeradio, Ltd., has announced a reorganization of its management structure upon the retirement of the operations manager, Wg. Cdr. R. C. Lawes, O.B.E., on December 31 next. Mr. L. M. Layzell joins the management as technical manager, Mr. E. E. Warburg as commercial manager and Mr. J. P. Utterson as personnel manager. Wg. Cdr. Lawes' services will remain available to the company in a consultative capacity.

ARGOSY PROGRESS. — The first stage of the Argosy's tropical trials was completed two days ahead of schedule in Khartoum, and the aircraft has now gone on to Nairobi. Persistent low temperatures delayed the trials initially, but more than 25 hours were flown between September 24 and 30, with temperatures at the necessary high values.

DC-9 TURBOFAN.—A prototype Pratt & Whitney JTF-10A-1 turbofan will run before the end of the year and deliveries are expected by April, 1961. The engine is similar in configuration to the front-fan JT3D. Thrust is 8,250 lb.; weight, 2,110 lb.; by-pass ratio, 1.5; cruise s.f.c., 0.87 lb./lb./hr.

ROTODYNE LECTURE. — Dr. H. Roberts will lecture about the Fairey Rotodyne to the Aircraft Recognition Society at 7 p.m. on October 21. The lecture will be at the Royal Aeronautical Society, 4 Hamilton Place, London, W.1.

MORE CARAVELLES.—Alitalia has confirmed an order for four Sud-Aviation Caravelle IIIs, for delivery in May, June and July next year. An option on four Caravelle VIs for delivery in 1961 has also been taken.

TROOPING FIRST.—Hunting-Clan Air Transport operated its first Britannia trooping flight to Aden on October 7. The journey takes 14 hours and stops only at Benina. The first trooping flight to Nairobi will leave on October 17. Also stopping at Benina, this service will take 15 hours.

HERALD AWAY.—The Dart Herald prototype G-AODF left Blackbushe on October 4 for an 11-week demonstration tour in Australasia and the Far East, starting at Rongotai, Wellington's new airport. It will be joined later in the tour by the first production aircraft.

PAKISTAN FRIENDSHIPS.—Latest order for Fokker F-27s is from Pakistan International Airlines, for three to be delivered in 1960, and an option on six for 1961 delivery. F-27s have now flown 67,000 hours, with 80 delivered of 150 ordered from Fokker and Fairchild.

B-58 CAPSULES.—The three crew members of the Convair Hustler are to have individual escape capsules; their design and production is by the Stanley Aviation Corporation of Denver. For ejection, each capsule will close round the crew members, who will therefore not require bulky flight clothing, and will be lowered by parachute after clearing the aircraft; it will contain radio, food and emergency supplies, and will float.

ARTICLE AWARDS.—The Electronic Engineering Association and the Radio Council are to make twenty-five guinea awards to the authors of meritorious technical articles on radio and electronics. Authors must earn less than 25% of their income from writing.

Mr. E. E. Warburg and Mr. L. M. Layzell, commercial and technical managers, respectively, of International Aeradio.

Personal Flying

Details are now available of the Cessna 210, which is the first of the company's high-wing monoplane range to incorporate a retractable undercarriage. The Model 210 is powered by a 260 b.h.p. Continental IO-470-E flat-six engine with fuel injection, driving a constant-speed airscrew. Throttle, pitch and mixture controls all have vernier adjustment for accurate selection of power, and engine cooling is regulated by an adjustable cowl flap.

With four seats in its spacious cabin, the Cessna 210 has a gross weight of 2,900 lb. and a maximum speed of 199 m.p.h. Cruising speed, at 75% power, is 190 m.p.h. at 7,000 ft. The spring-steel tricycle undercarriage is of the standard Cessna type, but the main legs retract aft into fuselage recesses, which are then fully enclosed. The nosewheel retracts forwards. U.S. price of the 210 in standard form is $22,450.

• • •

Now that Croydon is finally closed, energetic attempts are being made to build up Biggin Hill as London's flying training centre and executive airport. Although not quite so close to the capital, Biggin is only about 15 miles out, and is rather better situated for flights to the Continent, as was proved by the recent London-Paris air race. It is reasonably served by public transport, and plans are in hand to arrange car-hire facilities for visiting pilots at favourable rates.

A big future, in fact, is planned by Sqn. Ldr. John Maitland and Mr. Edward Drewery, who have acquired a controlling interest in Surrey Aviation, Ltd., the original lessees of the airfield. The company took over the grass area and two 800-yd. runways of Biggin Hill, together with one of the hangars, and is now negotiating for the use of the main 2,000-yd. runway.

Many problems accompany the reorganization. Much of the airfield was left in derelict condition and a great deal of work, accompanied by substantial expenditure remains necessary. Under the terms of the lease, Surrey Aviation must supply adequate air traffic control facilities, but as the Air Ministry refuses to allow the magnificent new, but now disused, control tower to be leased, even on a short-term basis, the company is having to build its own structure for this purpose.

The newer tower is to be erected in front of the club area, on the south-east side of the airfield, but the cost of its construction, and of equipping it with VHF and VDF equipment must inevitably be contributed to by landing fees for all visiting aircraft. These fees are slightly below M.T.C.A. rates for club and privately owned light aircraft, and must also contribute towards the salary of a full-time controller. Another very heavy item of expenditure is the extraordinarily high rental claimed by the Air Ministry for the hangars at Biggin Hill.

Official help certainly seems less forthcoming than it should be to get Biggin going for personal flying. Despite the magnificent Service lighting at the airfield, its use is denied to the civil operators, who must lay out an antiquated goose-neck flarepath for night flying. The path to private flying progress in this country is ever bedevilled by bureaucratic boulders, but given reassurances on a long-term lease, and a continuation of the enthusiasm possessed by its present operators, Biggin might well develop into a first-class London centre for non-scheduled operations.

• • •

● From the A.B.A.C. we hear that its annual dinner is to be held on Wednesday, December 2, at the Waldorf Hotel, London. Two new clubs were affiliated in August: the Rhoose Flying Club and the Easy King Flying Group, Sywell. The latter group was formerly a member of the P.F.A.

● At Denham, two of the flying club members, Joan and Denis Bootle, have opened the Hawksridge Restaurant on the airfield, offering meals and overnight accommodation. A Link Trainer installation is nearly complete and should be operational soon. A busy winter social and instructional programme is being organized, while a Chipmunk is being readied for day and night flying, including night cross-countries for commercial qualification. Air visitors to Denham are reminded that a variable current is in force, and the signals square should be checked before landing.

● Fair Oaks Aero Club report that the display of Piper Aircraft by Vigors Aviation on September 26-27 was of great interest to members and visitors. The company's four pilots were kept very busy on demonstration flights in an Apache, two Comanches, two Tri-Pacers and a Super Cub. In the past three months, the company has sold one aircraft per week. The navigation exercise for the Fair Oaks Cup was won by Messrs. Wein and Hall in September, during which the club flew 661 hr. 20 min. This brought the total for the year to 4,687 hr. 40 min. Winter instructional courses are being arranged for P.P.L. theory and the restricted R/T licence.

● At Sandown, Isle of Wight, on September 26-27, several parachuting clubs held a spot-landing competition, in conjunction with the Tiger Club. Jumps were made from 2,500 and 3,700 ft. with respective delays of seven and 10-15 sec. before opening. Overall winner was Cpl. Norman Hoffman, R.A.F., captain of the Skydivers team. Second was another Skydiver, Sgt. Tony Charlton, while third was Jimmy Basnett, chief instructor of the British Parachute Club. The display closed with a mass descent with a 55-sec. delay by five Skydivers, Tony Miller and Mike Reilly of the Stapleford Swallows, from a Rapide at 10,500 ft. The only incidents during the week-end were the torn parachutes of Johnny Hogg and Denis Lee, and a forced landing through engine failure by Norman Jones in the "Archbishop" Tiger Moth.

Gliding Notes

by Dr. A. E. Slater

NORFOLK and Norwich Aero Club, which used to have a gliding section before the War, but lost its home at Mousehold aerodrome, has started up again at Swanton Morley, so Alfred Warminger writes. He has, therefore, resigned from the Air Training Corps in order to devote himself to the resuscitated club, and it can be taken for granted that he hopes to resuscitate the gliding section too, especially as the club has two Tiger Moths fitted for towing.

The pre-war gliding section found one snag in being part of an Aero Club—all the members expected automatically to be allowed on the glider, a Kestrel; so it was repeatedly crashed by "experienced aeroplane pilots," one of whom managed to get into three successive spins off an auto-launch to only 700 ft., and hit the deck during the third.

Warminger proposes to use his own Skylark 3 and a Swallow, and later, if justified, a T-42 two-seater.

Swanton Morley, where the gliding group would operate, is 15 miles W.N.W. of Norwich. Meanwhile a Norfolk Gliding Club has been formed, and has permission to fly at Tibenham airfield, 13 miles S.S.W. of Norwich. So, in north-easterly cross-country winds, they would by-pass the wooded area around Thetford on opposite sides. The new club has the use of a hangar, a repairable control tower for a clubhouse, a Tutor, and a member's private Olympia, and has ordered a T-21.

Fifty years after the first motor-assisted flights were made from Doncaster racecourse, the first motorless flights have been made from Doncaster airport by visitors from the Yorkshire and Halifax Clubs to help in launching the new Doncaster and District Gliding Club. A T-21 is on order and another two-seater, partly built, may be acquired.

The latest news, from the *Doncaster Gazette*, is that the club is forming a "youth section" and is asking permission to convert an old guardroom into a "teenagers' clubroom." Although the club is reported to have over a hundred members, this seems an unfortunate idea—as unfortunate as the one-time proposal at Dunstable, in the pre-war solo-training days, to have a clubhouse on the hill-top for the bungy-launched beginners, while the more advanced, who had winch launches from the bottom, would use the clubhouse there. The scheme would have split the club into cliques, and was fortunately abandoned.

SINCE a reference in *Aviasport* to an imaginary "Olympia 11B" has evidently been taken from some illiterate British document, it would be as well to warn our French colleagues that many gliding people over here are so ignorant as to think that Olympia 11 (eleven) means the same thing as Olympia II (two), and they will even write Skylark 111 (one hundred and eleven) when they mean Skylark III (three).

I have found such people quite incapable of conceiving that there could possibly be more than one numbering system, and any attempt to explain the matter merely results in their going to the other extreme and typing II (two) when they mean 11 (eleven). The practice of THE AEROPLANE AND ASTRONAUTICS is to put 2, 3, etc., except where an ancient type has been known traditionally by its Roman number.

• • •

FORTHCOMING social events at Lasham are: Farewell party to "Bill" Gotch (Manager), October 17; Christmas party, December 19; and the Surrey Club's 21st birthday on December 4 will be celebrated in London. The Southdown Club has its Annual Social evening at Hove on October 17.

To the fliers of BOAC* from the suppliers to BOAC

congratulations on your 40th Anniversary

* and to all their colleagues on the ground, and to their forerunners since 1919.

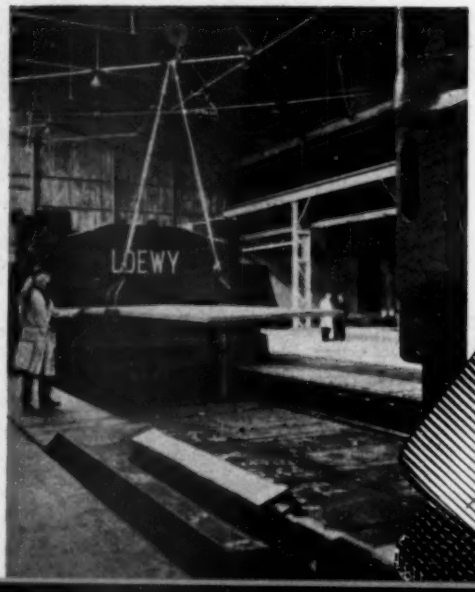
SHELL

SHELL AVIATION SERVICE

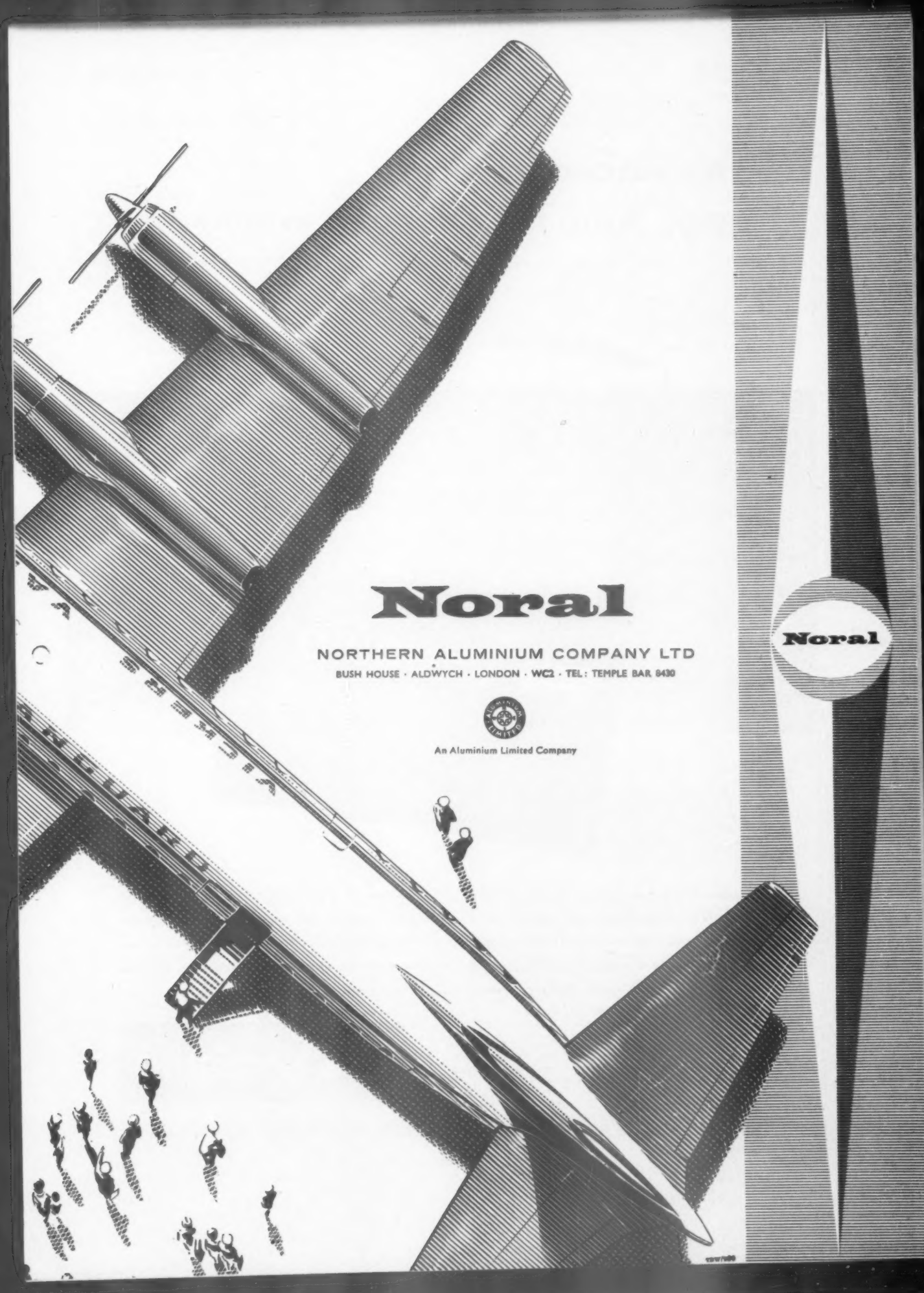
Noral gives wings to progress

No user of aluminium demands more from his material than does the aircraft constructor. In the 25 years of swift progress since all-metal construction became general, Noral has led in meeting these increasingly exacting requirements. When thick, stress-relieved alloy plate was needed for the new 'integral' method of construction in such advanced aeroplanes as the Vickers 'Vanguard', Noral were again in the lead with a massive plate stretcher capable of exerting a pull of 4,000 tons, together with special heat-treatment and ultrasonic inspection equipment. Whatever your business, Noral experience and production facilities are at your disposal.

The 4000-ton plate stretcher at Noral's Rogerstone Works.



The alloys that move with the times!


Noral
NORTHERN ALUMINIUM COMPANY LTD
BUSH HOUSE · ALDWYCH · LONDON · WC2 · TEL: TEMPLE BAR 8430
An Aluminium Limited Company
Noral

APPROVED FOR

THE WORLD'S LEADING AIRCRAFT

Aeroquip flexible hose with detachable re-usable fittings is used on aircraft all over the world. Its reliability has been tried, proved and approved, and its versatility is outstanding. The Aeroquip Catalogue for the Aircraft Industry contains sections on British and American standards for high, medium and low pressures, light weight engine assemblies, fire resistant hydraulic hose and P.T.F.E. (polytetrafluoroethylene), with the latest patented "super gem" fittings.

Manufacturers of 'SuPerfect' Oil Seals, Hydraulic Packings and 'O' Rings; 'Romet' water pump seals and mechanical pump seals; 'Fidrac' mechanical rubber mouldings; 'Redcaps' Polythene Protective Caps and Plugs.

Aeroquip

SUPER OIL SEALS & GASKETS LTD., FACTORY CENTRE, KINGS NORTON, BIRMINGHAM, 30.

Correspondence

Flying Inns

YOUR Gloucester correspondent, Mr. L. Morgan (Sept. 25), appears to have overlooked his near neighbour, "The Air Balloon" at Birdlip, which must be one of the oldest candidates, though I believe there is another at Bilston, Staffs. As a near miss may I suggest "The Propeller" at Croydon? If the class is to be extended to inns whose signs depict aircraft, there is "The Battle of Britain" at Northfleet (1948) and "The Startled Saint" at West Malling, presenting an astonished St. Leonard haloed with fighters from the nearby airfield.

Rye, Sussex. S. B. S. PIGROME.

"Frigate Bird III"

From Capt. Sir P. Gordon Taylor, G.C., M.C.

I WAS most interested to read Mr. Powell's very nice letter (Sept. 4) with its clearly stated information about the Sandringham VII, Bermuda, aircraft.

From his "in conclusion," however, I must have given the wrong impression in my article about the previous name of "Frigate Bird III." We knew, of course, that she was "St. George" when we bought her, the word "Bermuda" being a B.O.A.C. type classification.

Sydney. P. G. TAYLOR.

They Served Us Well

IT is sad to read that the Air Ministry no longer find it practicable to keep airworthy one Spitfire and one Hurricane to lead the annual Battle of Britain fly-past over London. The reason given is that the aircraft are "nearly 20 years old." This excuse is weak in the extreme when one considers that quite small organizations and even a few private individuals with nothing like the technical resources of the Air Ministry at their disposal, manage to keep aircraft of great vintage flying. Bristol Aircraft, Ltd., even display a 40-year-old Bristol Fighter, which still performs simple aerobatics!

The Spitfire and the Hurricane are as much a part of our heritage as Nelson's "Victory." I want in the years to come to show my children these aircraft as I and so many others remember them—alive and in their natural element—not as dust-covered museum pieces. There is already a distressing tendency to forget Battle of Britain day and allow it to lapse into an annual "Air Day," "Open Day" or even "Flying Display" as it was publicized at a local R.A.F. station.

I feel the Air Ministry should make a real effort to keep these aircraft in flying trim. They served us well and should never be forgotten.

Lanivet, Cornwall. J. EASTHOPE.

Curtiss-engined D.H.6

THE aircraft to which Mr. Kenworthy's broken prop was originally fitted need not necessarily have been an American aircraft. There is little doubt that it came into the country fitted to a Curtiss J.N.4, or as a spare for that aircraft, but at least one D.H.6, was fitted with a 90 h.p. Curtiss and a J.N.4 propeller. This was in 1921-23. The aircraft registration was G-EANJ.

I did a considerable amount of flying in this machine with the late T. N. Stack, but in the course of several hard flying seasons I do not remember any form of engine trouble and certainly no instance of engine failure. The early magneto troubles, referred to by your correspondent G. F. Smylie, were evidently satisfactorily overcome, for this particular engine proved its capacity to give very reliable service under the severest of operating conditions.

It is probable that the first Curtiss engines to be imported to this country were the pair fitted to a White and Thompson flying-boat some time before 1914. This, I believe, was the first twin-engined flying-boat to be built in this country.

Gosport, Hants. S. H. BOSTOCK.

Information Wanted

I AM endeavouring to collect data for a book entitled "Pilots Notes 1914-1918," this being an attempt to describe the handling characteristics of the selected types listed hereafter:—

Maurice Farman; B.E. 2c; D.H.2; Sopwith Pup; F.E. 2b/a; R.E.8; D.H.5; Sopwith Camel; Sopwith Triplane; S.E. 5/5A; Bristol F2b Fighter; Short 184; F-type flying-boat; Handley Page 0-400; Sopwith Dolphin and S.S. airship.

I am anxious to make contact with ex-pilots, observers and technical ground crews who were familiar with these types and who would be kind enough to assist with information.

Derby. L. F. HENSTOCK.

[Letters addressed to Mr. Henstock, c/o the Editor, will be forwarded. We imagine that such "Notes" can be extant for but few of the types mentioned.—ED.]

Groundabout

Spanner in I.A.T.A. Works. Mr. Watkinson, as Minister of Transport and Civil Aviation, was, it seems, more in earnest than we thought when he said we would, if necessary, "Go it alone" in the question of cheaper air fares. An Abyssinian paper, reporting his speech, notes that he said—nay, threatened—"We shall have to consider what we can do in our sabotage area, where matters are still under our control."

*

Serious Interval. We were delighted by the survival of Johnny Squier, distressed that he was neither traced nor rescued. The Americans have a rescue location aid which we might adopt. In wild and sparsely populated Alaska, I was told by Col. Don Graham, U.S.A.F., that his F-102 pilots' ejector seats and parachute packs automatically throw out radar-genic "Chaff" ("Window") in this kind of emergency.

*

The Press that Depresses. From Switzerland an Italian reader, Signor Diego Mazzonis, sends this Englishman a cutting from an Irish newspaper. It's about an American airliner operated by a French company, the Air France Constellation which lost a prop over the Atlantic, and is an extreme example of popular pressmanship—"Air-Drama . . . propeller ran amok . . . plunge towards sea . . . frantic radio . . . terror-filled hours . . . crippled airliner . . . miracle landing. . . ." Then the ultimate exaggeration: "Spray from the Atlantic waves swept through the hole in the cabin on to the shivering, frightened passengers." Even the usual anti-climax of the "perfect landing." Oh, well.

*

*

Wanted — Rotating Heart. *Worried Turbine Engineer, Derby,* writes: "Have you realized how inefficient is the human heart? It *reciprocates!*

*

Travel in Somnolence. Somebody seems to be looking ahead to Mach 3, or even rocket, passenger travel. Specification 2927 in the British Standards Yearbook informs us:—

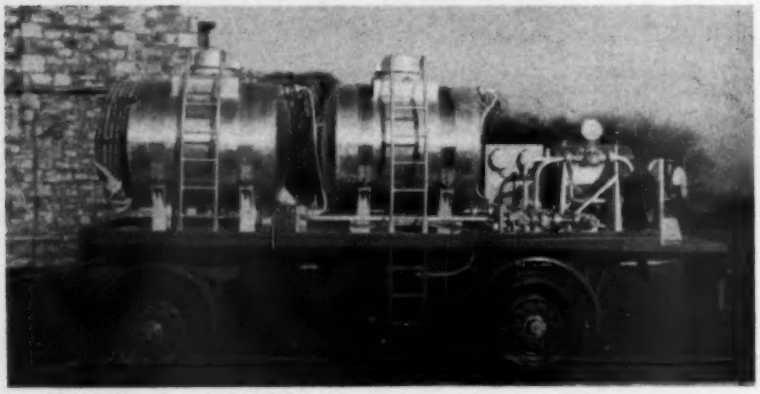
"*Anæsthetic airways.* Specifies essential features relating to size, description and design of anæsthetic airways, including requirements relating to functional suitability, durability and safety."

*

Wry Smile Dept. Another touching P.R.O. story: An A. AND A. staff member who saw "FORD 5-STAR CARS" being sky-written for 10 million Londoners to see, rang Dagenham for information about the operation. He was told: "Well, for the moment the thing is confidential."

by Lorenzo

NOTES AND EVENTS



ROCKET FUELLER.—A self-contained H.T.P. fuelling and dumping unit designed by Saunders-Roe (Anglesey). The equipment comprises two 500-gal., 99.5% pure aluminium alloy tanks, mounted on cradles on a Dyson trailer with a petrol-engine-driven Filton-Barske H.T.P. pump delivering 50 gal./min. A water pump and 80-gal. water tank are also mounted on the trailer.

SMITHS EXPANSION.—A comprehensive range of aircraft components, including BNC connectors and adapters, small AC motors, synchros and generators has been developed by Smiths Aviation Division. The BNC connectors and adapters are interchangeable with equivalent U.S. military types, and the Smiths synchro range covers over 20 different types.

M.O.S. ORDER.—Recently completing an initial M.o.S. contract for 30 aerodrome runway sweeper/collectors for use by the R.A.F., Zwicky, Ltd., has received a further order from the Ministry for 19 more machines. Zwicky runway sweeper/collectors are also in service at U.K. and overseas airports.

NEW PLANT.—Glass Yarns and Deeside Fabrics, Ltd., an associate company of Microcell, Ltd., has started an expansion programme to increase its glass-fibre output. Fibre drawing will begin in the near future from a battery of furnaces now being installed in a new factory at Camberley, which on completion will mark the first £750,000 stage of the company's expansion programme.

SEMICONDUCTOR FACTORY.—Texas Instruments, Ltd., of Bedford, has announced the signing of a contract for the construction of its new semiconductor plant. The occupation of this plant is scheduled to start in the autumn of 1960, and it will be in full production in early 1961. The total value of the project is approximately £1 million.

COMPRESSED AIR TOOLS. — Turbomachines, Ltd., has issued leaflets giving details of the company's new range of small air turbines and turbine grinders. These are claimed to be more powerful than those generally available. The leaflets are available from the company; its address is Station Rd., Dorking, Surrey.

TEDDINGTON EQUIPMENT. — A new Yearbook has been published by Teddington Aircraft Controls, Ltd. It provides a concise and up-to-date collection of purely technical data on some of the company's equipment.

NEW MAGNESIUM ALLOYS.—Magnesium Elektron Ltd., has produced two booklets giving full details of its new MSR and ZTY alloys. Entitled "MSR—A New High Strength Magnesium Casting Alloy" and "ZTY—A New Magnesium Wrought Alloy for use at Elevated Temperatures," these booklets can be obtained from the company's London office at 5 Charles II Street, St. James's, S.W.1.

Aviation Calendar

October 17.—R.Ae.S. Luton Branch, visit to the Shuttleworth Collection at **Old Warden.**

October 19.—R.Ae.S. Henlow Branch lecture, "Blind Landing," by W. J. Charnley, in Building 62, The Technical College, **Henlow,** at 19.45 hrs.

October 21.—British Institution of Radio Engineers lecture, "Aviation Medicine," by P. V. Byford, at London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, **London,** W.C.1, at 18.30 hrs.

October 22.—University of London extra-mural studies lecture, "T/gram; Fair-weather Clouds," by Dr. R. S. Scorer, M.A., Ph.D., at the Kronfeld Club, Basement, 74 Eccleston Square, **London,** S.W.1.

October 22.—R.Ae.S. lecture, "Problems of Interplanetary Navigation and Atmospheric Re-entry," by T. R. F. Nonweiler, at Church House, Westminster, **London,** S.W.1, at 19.00 hrs.

October 22.—R.Ae.S. Isle of Wight Branch lecture, "Air Traffic Control and Jet Operations," by H. E. Smith, at the Clubhouse, Saunders-Roe Sports and Social Club, Church Path, **E. Cowes,** at 18.00 hrs.

October 27.—Radar and Electronics Association lecture, "Electronics in Supersonic Flight," by F. W. Page, B.A., F.R.Ae.S., at the Royal Society of Arts, John Adam Street, Adelphi, **London,** W.C.2, at 19.30 hrs.

October 27.—Society of Instrument Technology lecture, "Modern Developments in Optical Instruments," by J. H. Bach, B.Sc., and G. E. Fisher, at Manson House, 26 Portland Place, **London,** W.1, at 19.00 hrs.

October 27.—R.Ae.S. main lecture, "Aircraft Fatigue—a survey of current thought," by R. J. Atkinson, at Church House, Westminster, **London,** S.W.1, at 19.00 hrs.

October 28.—R.Ae.S. Weybridge Branch debate, motion, "That this house considers that the craze for speed is technically unsound, economically undesirable and has taken all the romance and most of the interest out of travel," at the Napier Senior Staff Canteen, **Luton Airport,** at 18.15 hrs.

October 28.—R.Ae.S. Weybridge Branch lecture, "Kinetic Heating of Aircraft Structure," by A. W. Kitchenside, B.Sc. (Eng.), A.C.G.I., A.F.R.Ae.S., at the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., **Weybridge,** at 18.10 hrs.

October 28.—British Institution of Radio Engineers' Radio and Navigational Aids Group inaugural meeting, address on, "A Historical Survey of Radar and Radio Aids to Aircraft Navigation," by Air Marshal Sir Raymund G. Hart, at the London School of Hygiene and Tropical Medicine, Keppel Street, **London,** W.C.1, at 18.30 hrs.

Company Notices

NEW COMPANIES

Viking Industrial Projects, Ltd. (637,129).—Private co. Reg. September 14. Cap. £5,000 in £1 shares. Objects: To carry on the business of general, precision, mechanical, motor, aeronautical, electrical and constructional engineers. Subscribers: Charles Murray, 40 Jayshaw Avenue, Birmingham, 22a, production engineer (director Les K. Reay, Ltd.), 50 shares; Jacques Sadler, 18 Regent Crescent, Skipton, engineer, 1 share; Marjorie Brown, 4 Wolseley Rd., South Shore, Blackpool, 1 share. First director: Charles Murray. Sec.: Marjorie Brown. Solrs.: A. Hyslop, Skipton. Reg. off.: Hope Shed, Skelton Street, Colne, Lancs.

Tropical Island Holidays, Ltd. (637,194).—Private co. Reg. September 15. Cap. £5,000 in £1 shares. Objects: To carry on the business of travel agents and contractors. Subscribers (each with one share): Mrs. Dorothee Anstee, Box 54, South Kinangop, Kenya, E. Africa; R. S. Anstee, Box 54, South Kinangop, Kenya, E. Africa; Peter J. Adams, Bickley Court, Bickley, Kent, manufacturers' agent. Solrs.: Arthur Hunt and Hunt, 9 Old Burlington Street, W.1.

Kaiser Aluminium Co., Ltd. (637,249).—Private co. Reg. September 16. Cap. £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in aluminium, aluminium products of all kinds and other materials used in the aluminium industry. Subscribers (each with one share): Robert Banks, solicitor's managing clerk, and P. E. V. Oakley, solicitor's articled clerk, both of Essex House, Essex Street, Strand, W.C.2. Solrs.: Kenneth Brown, Baker, Baker, Essex House, W.C.2. Reg. off.: Essex House, Essex Street, Strand, W.C.2.

INCREASE OF CAPITAL

C. W. Harrison (Contractors), Ltd. (380,858).—Cleaners of interceptors in garages, hangars, aerodromes. 4B New High Street, Headington, Oxford. Increased by £1,000, in £1 ordinary shares, beyond the reg. cap. of £1,000.

Personal Notices

BIRTHS

Batten.—On September 26, at 41 Broadfield Road, Barnstaple, Devon, to Kathy (*née* Edwards), wife of Flt. Lt. Gene Batten, R.A.F.—a daughter.

Gibbons.—On October 3, at the Ionbridge Nursing Home, to Bridget Ann (*née* O'Hanlon), wife of Flt. Lt. B. K. W. Gibbons, R.A.F.—a daughter.

Harding.—On October 1, at R.A.F. Hospital, Wegberg, Germany, to Jean (*née* Watkins), wife of Sqn. Ldr. M. T. Harding, R.A.F.—a son.

Hollingworth.—On September 29, at the David Bruce Military Hospital, Imtarfa, Malta G.C., to Patricia (*née* Ault), wife of Sqn. Ldr. Roy Hollingworth—a son.

Mellor.—On September 27, at home, to Paddy, wife of Flt. Lt. E. V. Mellor, R.A.F.—a daughter.

Richardson.—On September 29, at R.A.F. Hospital, St. Athan, to Marianne, wife of Flt. Lt. F. W. Richardson, R.A.F.—a daughter.

Spiers.—On September 30, at R.A.F. Jever, Germany, to Cynthia (*née* Williams), wife of Sqn. Ldr. R. J. Spiers, R.A.F.—a daughter.

Steer.—On September 28, at Carlton Lodge Maternity Home, Harrogate, to Brenda (*née* Johnson), wife of Flt. Lt. J. Steer—a son.

Thompson.—On October 4, at Cuckfield Hospital, to Priscilla (*née* Hett), wife of Lt. Geoffrey Thompson, R.N.—a daughter.

Warson.—On September 29, at R.A.F. Hospital, Wegberg, Germany, to Sheila (*née* Curtis), wife of Flt. Lt. Murray Warson—a daughter.

MARRIAGE

Forse-Gordon.—On September 26, at St. Columba's, Pont Street, London, Flt. Lt. B. E. C. Forse to Norma Mary MacLennan Gordon.

DEATH

George.—On September 30, in a flying accident in Southern Cameroons, Flt. Lt. John Eldrick George, R.A.F.

The Caribou joins the U.S. Army

Designed by the de Havilland Aircraft of Canada as a civil transport for the world's less accessible areas, the Caribou's outstanding STOL and load-carrying capabilities made it the choice of the United States Army for its close support aircraft requirements. The first Caribou went into service with the United States Army in October of 1959.

De Havilland Aircraft of Canada

DOWNSVIEW ONTARIO

WASHINGTON OFFICE: TOWER BLDG., 14TH & 'K' STS., N.W.

in Guided Missile assembly

ACCURACY IS VITAL

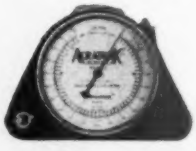
ACRATORK torque spanners and setting rigs are approved for torque applications in the assembly and maintenance of Britain's guided missiles.

ACRATORK

PRECISION TORQUE SPANNERS

SPANNERS. Sixteen standard models provide for all loads from 4 oz./inches to 850 lbs/feet.

TEST RIGS. For checking and setting all types of torque spanners and wrenches. Five models cover all loads up to 1,000 lbs/feet.



World Distributors:

CORY BROTHERS & CO. LTD.

Corys' Buildings, Cardiff. Telephone: CARDIFF 31141

RUMBOLD

LIGHTWEIGHT SEAT

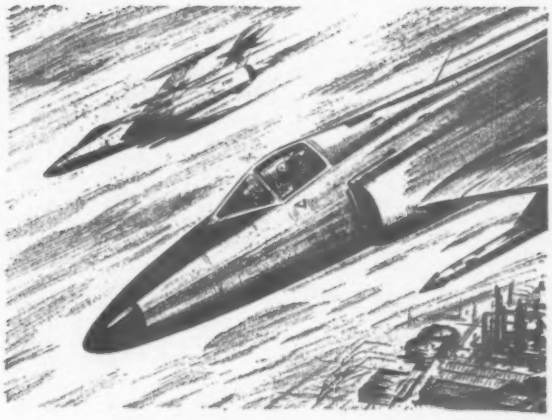
9G fore and aft

With detachable upholstery

L. A. RUMBOLD & Co., LTD.,

KILBURN, LONDON, N.W.6

TELEPHONE: MAIDA VALE 7366-7-8



FLYING POWER . . .

The power to shock a jet into life, electric power to make cockpit and cabin bright, power to keep the compass true and control sure . . . this is what *we* mean by flying power. From jet ignition to complete electric installations, AEI are supplying this flying power for today's leading aircraft.

A.C. and D.C. motors and generators.
Motor generating sets with electronic regulators.
Gas-operated turbo starters · Magnetos

AEI

electrical equipment for aircraft

ASSOCIATED ELECTRICAL INDUSTRIES LIMITED
AIRCRAFT EQUIPMENT GROUP COVENTRY, ENGLAND

A5454

BRYANS ACCELEROMETER TESTER

CATALOGUE No. 1800

BRYANS AEROQUIPMENT LIMITED

Specialists in precision measurement of pressure, temperature and speed. Design and production facilities available for test equipment and multiple panel building including electrical and electronic work.

WILLOW LANE · MITCHAM JUNCTION · SURREY
TELEPHONE: MITCHAM 5134 (5 Lines)

AT LAST
THE INCOMPARABLE BILL PEGG
tells it all...

He's one on his own: perhaps the greatest of all Britain's test pilots. Time and again, Bill's hit the headlines. Yet the **real** stories of his unique contribution to Britain's aviation greatness have **not** been told . . . because as yet only Bill and a handful of aviation's top men **know** the extent of his service, skill—and courage.

Today—**exclusively in the DAILY HERALD**—Bill Pegg starts to unfold his full astonishing story. It is too good to miss!

The BILL PEGG story—starts TODAY (Friday) in

DAILY HERALD

PHILLIPS & WHITE LIMITED
A.R.B. APPROVED STOCKISTS FOR
AIRCRAFT ACCESSORIES, SPARES & COMPONENTS

★Buying Agents for Overseas Aircraft Operators
★Suppliers to Foreign Governments, Airlines, Flying Clubs and Private Owners
★Our Stocks include:
Aircraft Navigational Equipment
Instruments Spares and Parts
Relays and Regulators
Control Units and Connectors
Resistors and Rheostats
Aircraft Generators and Spares
Flowmeters and Fuses
Thermostats and Transformers
Suppressors and Sockets
Plugs and Pumps
Aircraft Motors and Compressors
Ram Units and Rectifier Units
Electrical Components and Parts
Spares for most Ancillary Items
★Complete Gyrosyn Compass Installations Mark 4B and Mark 4F—Civil Types CL2 and CL1A
★Electric Artificial Horizons—Types HL5 and HL6
★Armstrong Siddeley Cheetah and De Havilland Gipsy Major and Queen Engine Spares
★Quotations rapidly given against all enquiries
★Stock details will be given on request
★Please write, cable or telephone your requirements.

ADDRESS:
61, QUEEN'S GARDENS, LONDON, W.2
Telephones: Ambassador 8651 and 2764
Telegrams: GYRAIR London W.2 Cables: GYRAIR London
PHILLIPS & WHITE LIMITED

Aircraft Furnishing
• PASSENGER & CREW SEATING
• UPHOLSTERY & LOOSE COVERS
• FOAM RUBBER & MOULDED HAIR FILLINGS
• FLOOR COVERINGS—TEXTILE EQUIPMENT
• "KARGO-PAK" FREIGHT CONTAINERS
• PASSENGER SAFETY BELTS
Repairs & Renovations
LATEX UPHOLSTERY LTD.
THE LEADING SPECIALISTS
41, LONSDALE ROAD, LONDON, W.11
TELEPHONE: BAYSWATER 6282/5

Precision Sheet Metal Workers and Light Engineers to the Aircraft Industry
Manufacturers of fabricated parts and assemblies in ferrous and non-ferrous metals. Tools, jigs and machined parts for the assemblies can be produced in our own workshops.
Let us quote for your requirements.

M.O.S. Approved D.G.I. No. 50037 *Fully Approved A.R.B. Ref. No. A1/2502/47*

C. W. FLETCHER & SONS LTD.
STERLING WORKS, ARUNDEL STREET, SHEFFIELD, 1
ALSO MORTIMER WORKS, MATILDA LANE, SHEFFIELD, 1
Telephone: Sheffield 28049 & 28040 ESTABLISHED 1891 Telegrams: Assayed Sheffield 1

CLASSIFIED ADVERTISEMENTS

THE AEROPLANE and ASTRONAUTICS

PRESS DAY: Classified Advertisements must normally be received at Head Office by FIRST POST THURSDAY for the following Friday week's issue. Last-minute additions and deletions are accepted by telephone from trade advertisers up to noon. Advertisements received too late for a particular issue are automatically inserted in the succeeding one unless instructions to the contrary are received.

RATES—1/- per word (minimum 12 words 12/-). Each paragraph charged separately and name and address must be paid for. Semi-displayed setting £3-17-6 per single column inch. Centred lines 22/6. Series discounts of 5% for 13, 10% for 26 and 15% for 52 consecutive insertions, allowed to trade advertisers.

TERMS—Strictly net and prepayable. Monthly accounts for settlement by the end of the month following insertion are allowed to trade advertisers if satisfactory references are provided.

REMITTANCES—Cheques and postal orders should be crossed and made payable to TEMPLE PRESS LIMITED and instructions sent addressed to the Manager, "The Aeroplane and Astronautics," Bowling Green Lane, London, E.C.1.

DEPOSIT SYSTEM—Facilities are available to readers to purchase advertised goods through "The Aeroplane and Astronautics." Commission 1% (minimum 2/-) on amount deposited.

BOX NUMBERS—Private advertisers desiring to have replies sent care of "The Aeroplane and Astronautics," may do so on payment of 1/- to cover booking and postage, plus cost of four extra words. Box Numbers must not be used for the purpose of circularizing and the Proprietors do not undertake the distribution of such matter received. To avoid mistakes in forwarding, Box Numbers should be carefully and legibly copied and replies sent to Box A000, care of "The Aeroplane and Astronautics," Bowling Green Lane, London, E.C.1.

THE PROPRIETORS retain the right to refuse or withdraw advertisements at their discretion and are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

HEAD OFFICES: Bowling Green Lane, London, E.C.1, England. Telephone: Terminus 3636. Telegrams: "Pressimus London Telex." Telex: 23839.

BRANCH OFFICES: Bayliss House, Hurst Street, Birmingham, 5. Telephone: Midland 6616. 50 Hertford Street, Coventry. Telephone: Coventry 62464. 1 Brazennose Street, Manchester. Telephone: Deansgate 6114-8. 12 Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

AIRCRAFT FOR SALE

W. S. SHACKLETON, LTD.,
EUROPE'S LEADING AIRCRAFT BROKERS,
MAKE AN
EXCEPTIONAL OFFER
OF

DOUGLAS Dakotas from £8,000 each. 11 aircraft from Trans Australia Airlines are now available for delivery during October and November.

EX C47 and C47 A aircraft, they are presently fitted with passenger floors and doors, but are suitable for conversion to freight duty if required.

ALL aircraft equipped with P. and W. 1830-92 engines, and fully feathering hydromatic Hamilton Standard 23E50 propellers.

PRICE varies with each aircraft depending on the hours since complete overhaul on the airframe. The cheapest is £8,000 sterling, ex Melbourne, and the dearest is £15,000.

FLIGHT delivery to destination named by customer will be made at cost.

FULL details from the sole agents for Europe.

W. S. SHACKLETON, LTD.,
175 PICCADILLY, LONDON, W.1.
Phone, Hyde Park 2448-9.
Cable, Shackhud, London. 504-12

ROLLASONS for Tiger Moths. Croydon 5151. zzz-708

GEMINI, Twin Cirrus II engines, full dual controls, radio, further details Box A047, care of THE AEROPLANE AND ASTRONAUTICS. 505-8887

AUSTER Autocar, Gipsy Major 10, Series II, airframe 1,013 hours, engine, 376 hours since major overhaul, C. of A. 23.4.60, Plessey 6-channel V.H.F., generator, spotter roof, door for large air survey camera installation and drift sight, price £2,100. Box A031, care of THE AEROPLANE AND ASTRONAUTICS. 504-8

TIGER Moth with full C. of A., engine hours since complete overhaul, 350, dual controls, standard instruments, navigation lights and inter-com., price £675 o.n.o. Western Airways, Ltd., Weston-super-Mare 2700. 504-6

AIR COURIERS, LTD., Biggin Hill 2233, offer:—

AVRO 19 Series 2 (metal wings and tailplane), constant speed feathering propellers, VHF and radio compass, new upholstery and year's C. of A.

RAPIDE, completely rebuilt, recovered and repainted, very complete radio installation, long-range tanks and windscreen wipers, C. of A. just renewed.

GEMINI, Cirrus, fitted Murphy MR100, company-operated aircraft. Viking, exceptionally low hours, available inspection shortly.

AIR COURIERS, LTD., Biggin Hill Aerodrome, Kent. 504-11

TRAVELAIR, LTD.,
AIRCRAFT SALES AND FINANCING SPECIALISTS.

HERON 1B, full airline, standard, excellent condition, £17,000 each.

DOVE 1B, two available, full airline standard, except deicing, £9,500 each.

DOUGLAS D.C.3 for lease passenger-cargo convertible, wide doors, £17 per hour.

DOUGLAS D.C.6, two available, all hour since overhauled engines, excellent condition, total U.S. $500,000 for both. This offer is a really exceptional opportunity.

AND FOR THE PRIVATE AND BUSINESS PILOT

MOONEY Mk. 20 Series. The finest value in new high performance 4-seater aircraft, £6,850. Delivered U.K. duty paid; also used Piper Tri-pacers, Comanches, Apaches, Beech Bonanzas, Travelairs, Twin Bonanzas, Super 18, Cessna 172, 182, 310. These aircraft have been selected by our New York associates as being the best proposition on the market.

H.P. Terms gladly arranged, and for full details contact:—

TRAVELAIR, LTD., 115 Oxford St., London, W.1. Phone, Gerrard 3382. 504-10

DERBY AVIATION LTD
AIRCRAFT & ENGINE OVERHAULS
SALES — SERVICE — TUITION
SCHEDULED AND CHARTER OPERATORS
DERBY AIRPORT
Telephone ETWALL 323

FOR IMMEDIATE SALE
we offer an
AUSTER J5S AIGLET TRAINER
in excellent condition and with numerous extras.

Also, we have a stock of
SPARES for MESSENGERS and GEMINI
All enquiries to Derby Offices.

LONDON OFFICE: Tel: ABBey 2345
78 BUCKINGHAM GATE, S.W.1

GUARANTEED R.L.A.
LAMINATED ALUMINIUM
USED ON MOST IMPORTANT AIRCRAFT
A.I.D. & A.R.B.
B. ATTEWELL & SONS LTD.
IVER BUCKINGHAMSHIRE

PIAGGIO EXECUTIVES
THE SIX/EIGHT SEATER P.166, THE P.136-L AMPHIBIAN AND THE AEROBATIC P.149-D CAN BE IMPORTED ON AN OPEN GENERAL LICENCE WITHOUT DOLLAR WORRIES.
Ask your dealer, or Write
Aero-Enterprises (Boreham Wood) Ltd.
17 Drayton Road, Boreham Wood, Herts.

AIR PARTS LIMITED
463 Caledonian Rd., London, N.7
Tel.: North 5018-9
Cables: Aircaly, London, N.7

For fully approved A.G.S. & A.N. hardware, quick service, enormous range. *Stock lists available.*

Overseas enquiries welcome.

BRITISH WIRE THREAD INSERTS

Precision made in Carbon Steel for Aluminium and Magnesium. Also in Stainless Steel and Bronze.

B.S.F.
Metric
B.S.P.
B.A.
Whitworth
Unified.

CROSS
MANUFACTURING CO. (1938) LTD.
COMBE DOWN, BATH, SOMERSET
Phone: COMBE DOWN 2355/8 *Grams:* CIRCLE BATH

R. K. DUNDAS, LTD.,
FOR EXCEPTIONAL AIRCRAFT AND SERVICES.

PROCTOR V. £395. This 4-seater, G-AKWA, total time 760 hours, only 274 engine hours, and with C. of A. to 1961, is the cheapest good aircraft we have been able to offer this year. To be perfect, it needs a respray, but is in excellent condition. A real bargain for the first inspector, at only £395.

SHORT SEALAND, 1951. It's not often that we can offer one of these excellent amphibians for inspection and sale in U.K. At present with 4 arm-chairs, tables and toilet, sound-proofed cabin, this multi-purpose amphibian, cruising at 174 m.p.h., over 775 miles, G-AKLV, total time 373 hours, is offered with Short Bros. and Harland overhaul, and new C. of A., and offers are invited.

EXECUTIVE DOVE. The best-maintained, smartest V.I.P. Dove you can imagine, G-ANGE has just had a Britavia Check 5, and is available for inspection at Ramsgate; with new C. of A., offers invited.

THESE aircraft and many others are offered by us exclusively. We also offer our unique services in U.S.A. on the purchase of all types of American aircraft, including free flight to New York to inspect, and in India and Hong Kong for the Far East.

R. K. DUNDAS, LTD., Dundas House, 59 Saint James's St., London, S.W.1. Phone, Hyde Park 3717. Cables, "Dundas, Piccy, London." 504-13

AUSTER Autocrat, privately owned, Auster maintained, blind-flying panel, metal propeller, Cirrus Minor IIa engine, new C. of A. Inspect at the Auster works at Rearsby, Leicestershire. 504-x9925

DC4 Aircraft for sale or lease. Box A024, care of THE AEROPLANE AND ASTRONAUTICS. 504-3

Aircraft Wanted

SCRAP aircraft, aluminium and stainless steel urgently required. Lowton Metals, Ltd., Lowton Saint Mary's, near Warrington. Leigh 1444-5. zzz-711

AIRCRAFT ACCESSORIES, SPARES AND COMPONENTS

COMPONENTS, spares and instruments for all aircraft and engines. A.R.B. released. Airtrade, Ltd., Croydon Airport. Phone, Croydon 0643. zzz-715

ROLLASONS for Tiger Moth and Gipsy engine spares. Croydon 5151. zzz-709

REPAIRCRAFT, LTD., The Common, Cranleigh, Surrey. (Cranleigh 536.) For instrument and autopilot overhauls. zzz-701

THE REGIONAL AIR TRADING CO., Croydon Airport, for Rapide spares of every description. Phone, Croydon 8521. zzz-714

ROLLASONS are specialists in the overhaul of all Gipsy engines. Croydon 5151. zzz-710

PHILLIPS AND WHITE, LTD.

OFFER from stock a comprehensive range of new spares and components for the following engines: CHEETAH IX, X and XV, de Havilland Gipsy, Major and Queen series.

INSTRUMENTS and instrument parts, navigational equipment, electrical components and aircraft spares are also available from stock.

61 QUEENS GARDENS, London, W.2. Phone, Ambassador 8651, 2764. Cables, "Gyrair, London." zzz-720

AIRFRAME spares for Dakotas, Harvards, Piper Cub, Fairchilds, Argus, Beechcraft D-17S, Mosquito, Spitfire, Firefly. Engine spares for Pratt & Whitney, Armstrong Siddeley, Lycoming, etc. Accessories and instruments for all types of aircraft. A. J. WALTER, LTD., The Drive, Horley, Surrey. Phone, Horley 1420 and 4294. Cables, "Cubeng, Horley." 504-15

HELICOPTERS

HELICOPTER SERVICES, LTD., offer their aircraft for all charter services. 96 Piccadilly, London, W.1. Gro 5495-6. zzz-717

APPOINTMENTS BUREAUX

PLANAVIA INTERNATIONAL AERONAUTICAL APPOINTMENTS BUREAU, 338 Kilburn High Rd., N.W.6. Mal 3142. 504-17

CLOTHING

R.A.F. Officers' uniforms for sale, new and reconditioned. Fisher's, 86-88 Wellington St., Woolwich. Phone 1055. Kit also purchased. zzz-707

CONSULTANTS

R. H. STOCKEN, F.R.Ae.S., Eagle House, 109 Jermyn St., S.W.1. Whitehall 8863. zzz-696

R. W. SUTTON (CONSULTANTS), LTD., 7 Lansdown Place, Cheltenham. Phone 5811. 508-8865

HIRE AND CHARTER

RAPIDES for hire or charter. A. J. Whittemore (Aeradio), Ltd., Croydon Airport, Surrey. zzz-683

NOTICES

AIR TRANSPORT ADVISORY COUNCIL.

THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM SKYWAYS COACH AIR, LTD., OF 7 BERKELEY STREET, LONDON, W.1:—

APPLICATION NO. 3250 for a Normal Scheduled Service with DC3, Avro 748 and Hermes aircraft for the carriage of passengers, supplementary freight and mail between Lympne or Manston and Antwerp at a frequency of up to 10 return flights daily, for 10 years from date of approval.

FROM DON EVERALL (AVIATION), LTD., OF ELMDON AIRPORT, BIRMINGHAM:—

APPLICATION NO. 454/2 for an amendment to the terms of approval of the U.K. Internal Service which they are authorized to operate with DH89 and Dakota aircraft on the route Wolverhampton (opt)-Birmingham (Elmdon)-Coventry (Baginton) (opt)-Leicester East (opt)-Bembridge or Sandown (Isle of Wight) at a frequency of eight return flights daily until October 31, 1961, so as to enable them to operate also with Heron aircraft chartered from North-South Airlines.

APPLICATION NO. 3251 for a U.K. Internal Service to be operated with Heron aircraft chartered from North-South Airlines and also with DC3 aircraft for the carriage of passengers, supplementary freight and mail on the route Birmingham (Elmdon) -Coventry (Baginton) (opt)-Exeter at a frequency of six return flights weekly, for seven years from May 1, 1960.

FROM HUNTING-CLAN AIR TRANSPORT, LTD., OF LONDON AIRPORT, HOUNSLOW, MIDDLESEX:—

APPLICATION NO. 321/6 for amendment to the terms of approval of the Colonial Coach Class Service which they are approved to operate on the route London-Bizerta (tech)-Gibraltar with Dakota and Viking aircraft at a frequency of 42 return flights per annum (with not more than four nor less than two return flights each 28 days), so as to enable them to operate also with Viscount aircraft.

These applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. 504-9

SOLDERING EQUIPMENT BY LITESOLE

PRECISION SOLDERING INSTRUMENTS for the ELECTRONICS INDUSTRY

- Comprehensive Range
- Robust and Reliable
- Light weight
- Rapid heating
- Bit sizes 3/32in. to 3/8in.
- 'Permabit' or Copper Bits
- All voltage ranges 6/7v to 230/250v
- Prices from 19/6

British and Foreign Patents. Registered designs. Suppliers to H.M. and Foreign Governments. Agents throughout the world. Write for Booklet No. S.23

Illustrated is the 25 w. 3/16 in. replaceable bit model with safety shield. Sole proprietors and manufacturers:—

LIGHT SOLDERING DEVELOPMENTS LTD.
28 Sydenham Road, Croydon, Surrey.
Telephone: CROydon 8589.
Telegrams: Litesold, Croydon.

NEW BALL & ROLLER BEARINGS
Over 5,000,000 in stock
in more than 5,000 types
BRITAIN'S LARGEST STOCKS
WRITE FOR STOCK LISTS
CLAUDE RYE BEARINGS
895-921, FULHAM RD., LONDON, S.W.6
Phone: RENOWN 6174 (EXT. 24) TELEX 23453

ELECTRICAL EQUIPMENT

EX R.A.F. 12v. 25 A/H aircraft accumulators, unused and in original packing. Also complete type-G portable electric Flare Path with spares, suit flying club. Hermes, 64 Castleton Rd., London, E.17. Phone, Larkswood 1431. 504-18

ENGINES AND ENGINE SPARES

GIPSY Major Mk. 10 and Mk. 1 engines, part-exchange offered with your time-expired engine. Propellers for most types of light aircraft. Mitchell Aircraft, Ltd., The Airport, Portsmouth. Phone 717641. zzz-689

MISCELLANEOUS

SEARCHLIGHT required in operational condition. Interested purchase or hire. Box A044, care of THE AEROPLANE AND ASTRONAUTICS. 504-1

PACKING AND SHIPPING

R. AND J. PARK, LTD., 143-9 Fenchurch St., E.C.3. Phone, Mansion House 3089. Official packers and shippers to the aircraft industry. zzz-674

RADIO AND RADAR

SPERRY ZERO reader, Type ZL1 course selectors, control panels, flight computers and indicators; three complete installations in stock. A. J. Whittemore (Aeradio), Ltd., Croydon Airport, Surrey. zzz-684

STR12D, STR9Z, STR9X and most other British and American V.H.F. R/T equipment always in stock. A.R.B.-approved design installations into any type of aircraft. A. J. Whittemore (Aeradio), Ltd., Croydon Airport, Surrey. zzz-685

RADAR height-finding cabins, type 13/6, practically complete. Offers required. Box A011, care of THE AEROPLANE AND ASTRONAUTICS. zzz-218

SITUATIONS VACANT

A.F.R.Ae.S., A.R.B.Certs., A.M.I.Mech.E., etc., on "No pass, no fee" terms. Over 95% successes. For details of exams and courses in all branches of aeronautical work, aero engines, mechanical engineering, etc., write for 148-page handbook—free. B.I.E.T. (Dept. 703), 29 Wright's Lane, London, W.8. zzz-690

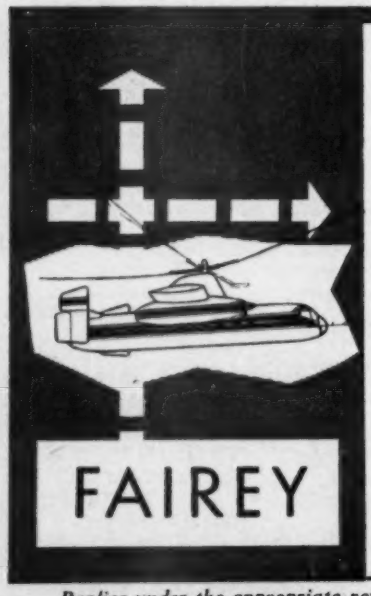
STRESSMEN, minimum 3 years' experience plus H.N.C. Western Stressmen's Registry, 39 Western Gardens, London, W.5. 504-x9924

A- and C- or C-licensed Engineers required for duties in the Middle East on Twin Pioneer aircraft—preferably unmarried. Good salary, leave and allowances. Apply Secretary, Scottish Airlines (Prestwick), Ltd., Prestwick Airport, Ayrshire. 505-8879

AIR CHARTER, LTD., require Flight Engineers for their Britannias. Minimum qualifications Flight Engineer's O licence and experience on multi-engine aircraft. Preference will be given to those who have passed a Britannia technical examination. Apply in writing to the Chief Pilot, Air Charter, Ltd., 21 Wigmore St., W.1. 505-8880

REQUIRED: Chief Engineer, licences A, B, and C, on Tiger Moth and Proctor aircraft. Apply: Box A045, care of THE AEROPLANE AND ASTRONAUTICS. 505-8886

ROYAL AERONAUTICAL SOCIETY. A vacancy exists for a technical assistant (male) with an engineering degree and at least two years' experience in structural design or research. The work involves the correlation of data on a wide range of engineering problems, liaison with aeronautical and other establishments on a national and international scale and offers an unusual opportunity for those interested in the latest structural and materials problems of aircraft and other vehicles. Applications in writing, giving details of experience and age should be made to the Head of the Technical Department, Royal Aeronautical Society, 4 Hamilton Place, London, W.1. 504-4



NEW DEVELOPMENT PROGRAMMES
at FAIREY AVIATION
offer opportunities of exceptional scope

To meet the needs of expanding programmes for development of the Rotodyne in both its civil and military applications, for design of the D.H. 121 airliner and important research work on high speed aircraft, additional staff are now required as follows:—

DESIGN OFFICES *(Ref. R/D7)*
SENIOR DRAUGHTSMEN
of at least H.N.C. standard with experience in
Aircraft Structures · Rotor Design · Electrical or Hydraulic Installations.
LOFTSMEN
for Full Scale Layout.
TECHNICAL AUTHORS and ARTISTS · WEIGHTSMEN

TECHNICAL OFFICES *(Ref. R/T7)*
STRESSMEN · AERODYNAMICISTS
DYNAMICISTS · APPLIED MATHEMATICIANS
STRUCTURAL TEST ENGINEERS
THERMODYNAMICISTS
PROPULSION ENGINEERS

all holding University degree, H.N.C. with endorsements or equivalent though not necessarily having aircraft experience. Young Men with H.N.C. (Mech.) or G.C.E. (A) in Maths & Physics can also be considered for junior positions.

Successful candidates will find pleasant working conditions at Hayes within easy reach of Central London or countryside, Pension and Insurance Schemes available, a Flying Club and the opportunity to become established in a rewarding career.
Interviews can be arranged where necessary in the evening or on Saturday mornings at Hayes or at our London Office.

Replies under the appropriate reference should be sent to the Personnel Officer, **FAIREY AVIATION LIMITED** HAYES MIDDLESEX

COMMERCIAL Pilot with some engineering knowledge and ability required to fly company's executive aircraft on charter and company's business. Box A042, care of THE AEROPLANE AND ASTRONAUTICS. 505-8884

MARSHALL

AIRPORT WORKS, CAMBRIDGE.

A SENIOR STRESS ENGINEER

REQUIRED

FOR STRESS ANALYSIS ON AIRFRAMES OF MODERN JET AND TURBO-PROP AIRCRAFT.

ABILITY TO LEAD JUNIOR AND INTERMEDIATE STRESSMEN ESSENTIAL.

MINIMUM QUALIFICATIONS: B.Sc. or H.N.C. PLUS FIVE YEARS STRESS EXPERIENCE (PREFERABLY ON AIRCRAFT BUT NOT ESSENTIAL).

GOOD SALARY AND HOUSING ASSISTANCE AVAILABLE TO SUCCESSFUL APPLICANT.

ALL APPLICATIONS WILL BE TREATED AS CONFIDENTIAL.

WRITTEN APPLICATION IN FIRST INSTANCE TO:

PERSONNEL MANAGER. 505-8882

ELECTRICAL ENGINEER.

REQUIRED by a medium-sized company to take charge of a small team with laboratory facilities engaged on the design of high-grade fractional horse-power, A.C. and D.C. motors and other electrical equipment. Sound previous experience essential. Good salary and pension facilities. Write giving full particulars to: Box A043, care of THE AEROPLANE AND ASTRONAUTICS. 505-8885

MARSHALL

AIRPORT WORKS, CAMBRIDGE

REQUIRE

DRAUGHTSMEN,

ELECTRICAL AND STRUCTURAL.

FOR WORK ON

MODIFICATION, TRIAL INSTALLATION AND DEVELOPMENT WORK ON MODERN AIRCRAFT.

GOOD STARTING SALARIES WITH HOUSING ASSISTANCE FOR SUITABLY QUALIFIED APPLICANTS.

APPLY IN WRITING GIVING FULL DETAILS OF EXPERIENCE AND CONVENIENT DATES FOR INTERVIEW TO:

PERSONNEL MANAGER. 505-8881

X-LICENSED electrician required. Apply Channel Airways, Southend Airport, Essex. Phone, Rochford 56460. 505-8883

EAGLE AIRWAYS, LTD., have an immediate vacancy for qualified flight navigator, salary according to experience. Apply Executive Officer, Eagle Airways, Ltd., Blackbushe Airport, Camberley, Surrey. Phone, Yateley 2371. 504-5

BRITISH AVIATION SERVICES (ENGINEERING), LTD.,

AT MANSTON, KENT,

FOR

RADIO ENGINEER A

LICENSED AIRCRAFT ENGINEER

HERCULES C.

PLEASE WRITE ALL DETAILS TO: GROUP PERSONNEL OFFICER, BRITISH AVIATION SERVICES (ENGINEERING), LTD., 62 BROMPTON ROAD, LONDON, S.W.3. 504-2

COMPETENT secretary with aviation experience needed in busy office of expanding professional organization in central London. Work varied and interesting. Salary according age and experience. Write Box A048, care of THE AEROPLANE AND ASTRONAUTICS. 504-16

Hawker Siddeley Aviation LIMITED

GUIDED WEAPONS

A. V. ROE & COMPANY LIMITED
Weapons Research Division, Woodford, Cheshire

INSTRUMENTATION ENGINEER

Required to take charge of a section working on the instrumentation required or testing missile propulsion systems and structures.

This is a senior post and will be filled by a person of some years' experience in this, or an allied field, a sound knowledge of electronics and with qualifications of at least H.N.C. standard. The post has considerable technical interest, covering a wide variety of work.

The Division is pleasantly situated in rural Cheshire, yet close to housing and shops and is on a main bus route. Canteen and social facilities are available and there is a superannuation scheme.

Applications, quoting reference No. WRD/WGJ/R.171/A should be addressed to:— The Chief Engineer,
Weapons Research Division, A. V. Roe & Co. Ltd., Woodford, Cheshire

HUNTING AIRCRAFT LIMITED

require

for the Aerodynamics Department

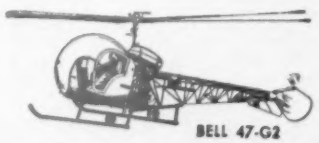
Performance Engineers
Project Aerodynamicists
Stability and Control Specialists

Contributory Pension and Life Assurance Scheme

Applications, giving full details of qualifications, experience, age and salary required and quoting ref. H.A.L./90/7, should be forwarded to:—

The Personnel Manager,
Hunting Aircraft Limited,
Luton Airport,
Beds.

WORLD WIDE
HELICOPTER SERVICE



BELL 47-G2

LONG or SHORT TERM HIRE

AUTAIR HELICOPTERS

75 Wigmore St., London, W.1
Telephone: WELbeck 1131

CROSS PERFECT PRECISION AIRCRAFT SPRING WASHERS

TO B.S. SPECIFICATION 2 SP.47

CROSS MFG. CO. (1938) LTD

COMBE DOWN, BATH. Tel.: Combe Down 2355/6

Air Traffic Control Officers

for

MINISTRY OF TRANSPORT AND CIVIL AVIATION

Age 23 to 35. Good education and recent aircrew or air traffic control experience essential. Salaries: while training £700 to £1,005 according to age; when fully trained according to age and station approx. £860 at age 25; £1,035 at age 30 or over rising to £1,395. Promotion prospects. Write for further particulars and application form to M.T.C.A. (ESB1/ATCO), Berkeley Square House, London, W.1, or to the Civil Service Commission (No. 4904/59), Burlington Gardens, W.1.

HANDLEY PAGE (Reading) LTD.,
THE AERODROME, WOODLEY, READING

have the following vacancies in their expanding Design Offices for work on Civil Aircraft.

SENIOR AERODYNAMICIST who will also act as ASSISTANT CHIEF AERODYNAMICIST. Applicant should have a degree and several years' practical experience. Successful applicant will be offered a house to rent.

TEST ENGINEERS for Structural and Mechanical Testing and for Electrical and Mechanical Testing, experience on strain gauge work, instrumentation and vibration testing.

DRAUGHTSMEN. Senior Electrical Draughtsmen who must have had several years' aircraft electrical experience.
Intermediate Electrical Draughtsmen preferably with aircraft experience.
Intermediate Draughtsman with experience in modern radio installation in aircraft.
Design Draughtsmen with aircraft structural experience.

PLANNING ENGINEERS for aircraft structures.

ELECTRICAL ILLUSTRATOR. Capable of preparing Electrical Diagrams for Maintenance Manual from Design Office Drawings.

WEIGHTS ENGINEER. High commencing and progressive salaries are offered.

Please send full particulars of experience, etc., to the Personnel Officer.

SILVER CITY AIRWAYS, LTD.

INVITE applications from flight engineers for Hermes operation based at Manston, Kent. Minimum qualifications required being O licence. Preference given to additional qualification maintenance engineers licence category C and/or A, pension scheme, generous overseas allowances.

APPLY in writing to Group Personnel Officer, 62 Brompton Rd., London, S.W.3. 504-7

SITUATIONS WANTED

EXPERIENCED captain (10,000 hrs.) available, free-lance or permanent, A.L.T.P. Group I, all types. Box A046, care of THE AEROPLANE AND ASTRONAUTICS. 505-x106

PILOT, ex-R.A.F., age 27, experience single, twin jet and piston, requires position home or abroad. Box A041, care of THE AEROPLANE AND ASTRONAUTICS. 505-x60

TUITION

EXETER AIRPORT, LTD. Courses for Commercial Pilot's Licence, from £625; Private Pilot's Licence from £101 5s. Contract rate solo flying, Austers and Tigers, £2 17s. 6d. per hr.; normal dual/solo rates, £3 7s. 6d. per hr.; twin conversions, £6 12s. per hr.; Chipmunk, £5 5s. per hr.; Messenger, £4 18s. 6d. per hr. Limited accommodation £5 15s. 6d. per week. Exeter Airport, Exeter. Phone 67433. zzz-705

LEARN to fly, £32 instructors' licences and instrument flying for £4 per hour; night flying £5 per hour. Residence 6 gns. weekly. Approved M.T.C.A. Private Pilot's Licence course. Specialized course for Commercial Pilot's Licence. Wiltshire School for Flying, Ltd., Thruxton Aerodrome (Andover Junction 1 hr. 15 min. from Waterloo), Hants. zzz-700

AVIGATION, LTD., provides full-time or postal tuition, or a combination of these methods, for M.T.C.A. pilot-navigator licences. Classroom instruction can be provided for A.R.B. General, certain specific types and performance schedule examinations. Link Training Dept., at Monarch 1364. For details apply Avigation, Ltd., 30 Central Chambers, Ealing Broadway, London, W.5. Phone, Ealing 8949. zzz-719

CAMBRIDGE AERO CLUB. M.T.C.A.-approved private pilot's licence course, 30 hours, £3 10s. per hour; D4 Link Trainer for radio compass and I.L.S. procedures to instrument rating standard, £1 per hour; instructor's courses, £3 10s. per night; night flying, £4 10s. per hour; Auster J.1.N., £3 15s. per hour, dual and solo. No fees or subscriptions. Club operates on all days, including week-ends. The Aerodrome, Newmarket Rd., Cambridge. Phone 56291. zzz-703

AIRWAYS AERO ASSOCIATIONS, LTD., Biggin Hill. M.T.C.A. approved P.P.L., C.P.L., I/R courses, Chipmunk, Aiglet, Proctor and twin-engined Super Aero. Competitive contract rates. Biggin Hill (BN9) 2735. 551-8875

LONDON SCHOOL OF AIR NAVIGATION, approved by Ministry for Commercial and I/Rating Personal coaching establishment, "the key of success" for all private and professional pilot and navigator qualifications, "refresher courses," home-study excellent alternative, type ratings, performance, Link and procedures, R/T, flying training. Officially appointed by H.M. Services, for correspondence scheme—refer Education Officer, or direct, 33 Ovington Square, Knightsbridge, London, S.W.3. Ken 8221. zzz-0712

PLYMOUTH. Ideal training area in holiday district for commercial and P.P.L. training. Tiger and Auster, £3 7s. 6d. per hr. Contract rate £2 17s. 6d. 50'o. Chipmunks for advanced flying £5 5s. Night flying available. Individual tuition with guided study. Plymouth Airport, Ltd., Crownhill, Plymouth 72752. zzz-704

A.S.T. Offers ab initio or refresher flying/technical training for C.P./I.R., A.T.P. and Group "A" Performance Rating. For details, apply The Commandant, Air Service Training, Ltd., Hamble, Southampton. Phone, Hamble 3001-9. 504-14

CLUB NOTICES, ETC.

SURREY AND KENT FLYING CLUB, Biggin Hill. Tiger, Hornet and Leopard Moths, Chipmunk and Prentice. Green Line 705 direct in one hour from London. Biggin Hill 2255. 504-0694

BOOKS AND PUBLICATIONS

INTERPLANETARY FLIGHT (3rd Impression), by Arthur C. Clarke. Describes the problems to be solved before space travel becomes a reality and the form rockets and spaceships may take. Illustrated, 169 pages, 9s. 6d. net from booksellers, or 10s. 2d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

E. D. WYNN & CO. (AIRCRAFT) LTD.

AIRCRAFT INSTRUMENTS AND ELECTRICAL ACCESSORIES

Staverton Aerodrome, Gloucester

Telephone: CHURCHDOWN 3264

THE "POWER AND SPEED" SERIES FOR BOYS. "Aircraft and Air Power," by F. G. Swanborough, of THE AEROPLANE AND ASTRONAUTICS, has been written for intelligent boys between the ages of 10 and 16. The author surveys modern military flying and includes chapters on combat aircraft, scientific aids and missiles. Other titles in this series are "Motorcars," "Locomotives" and "Ships and Shipbuilding." Illustrated, 112 pages, 10s. 6d. net from booksellers, or 11s. 5d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

"THE AEROPLANE" PICTORIAL REVIEW (No. 3). Compiled by the staff of THE AEROPLANE AND ASTRONAUTICS. This is the third annual miscellany of illustrations to appear in THE AEROPLANE AND ASTRONAUTICS, and covers highlights of aviation for the year ending autumn, 1958. Over 250 illustrations, 128 pages, 10s. 6d. net from booksellers, or 11s. 9d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

THE EXPLORATION OF SPACE (First Cheap Edition), by Arthur C. Clarke. Provides answers to the many questions the intelligent layman asks about the science of "astronautics." Over 375,000 copies sold in all editions. Illustrated, 212 pages, 8s. 6d. net from booksellers, or 9s. 5d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

"THE AEROPLANE" DIRECTORY OF BRITISH AVIATION, 1959. Incorporating "Who's Who in British Aviation." The current edition of this established annual reference work provides a complete and up-to-date guide to Service and Civil Aviation throughout the British Commonwealth. Contains full particulars of United Kingdom and Commonwealth Air Forces, Ministries, Organizations, Airlines, Industries, Flying Clubs and Aerodromes, and a Biographical Section with over 1,650 entries. 648 pages, price 30s. from booksellers, or 31s. 6d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

"THE AEROPLANE" DIARY, 1959. Compiled by the staff of THE AEROPLANE AND ASTRONAUTICS. Contains brief specifications of British civil, military and research aircraft (48 of which are illustrated), lists of British aircraft and aero-engine constructors, organizations, flying records, Royal Air Force Commands, and a vocabulary of aeronautical terms in six languages. Illustrated, 75 pages plus diary, 4s. 3d. net (Rexine) (including purchase tax) from booksellers, or by post 4s. 9d. from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

Books and Publications Wanted

OLD aviation and airship books wanted by world's largest dealer in aeronautical literature. Cash by return of post. Stuart, Fairlight Hall, Hastings. zzz-716

A.I.D. APPROVED

Rubbaglex

Patent No. 819567

Rubbaglex Sheeting is processed on 100% pure glass cloth, has very high tensile strength, is rot proof and combines flexibility and resiliency with non-stretching properties.

Impervious to Aromatic Hydro Carbons. Highly recommended for Gaskets, Washers, Jointings, Diaphragms, Sleevings, also Floating Roof Tank Seals, etc.

RUBBAGLAS LTD

ABFORD HOUSE
15 WILTON RD.
LONDON S.W.1
VICTORIA 6501

INDEX TO ADVERTISERS

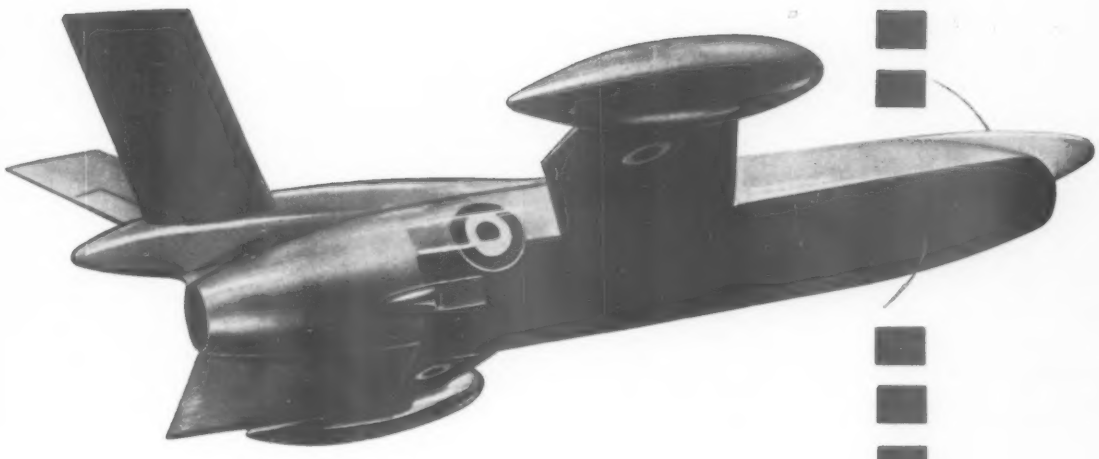
Name	Page
A	
Abbey Panel & Sheet Metal Co., Ltd., The	7
Acratork Engineering Co., Ltd.	50
Aero-Enterprises (Boreham Wood), Ltd.	53
Aircraft Manufacturing Co., Ltd.	33
Air Parts, Ltd.	53
Associated Electrical Industries, Ltd., Aircraft Equipment Group	51
Attewell B., & Sons, Ltd.	53
Autair, Ltd.	55
B	
Blackburn Aircraft, Ltd.	35
Boeing Airplane Co.	32
B.P. Aviation Services	28
Bristol Aerojet, Ltd.	19
Bristol Siddeley Engines, Ltd.	2, 3
Brown, David Construction Equipment, Ltd.	8B
Bryans Aeroquipment, Ltd.	51
C	
Canadair, Ltd.	4C, 4*A
Cross Manufacturing Co. (1938), Ltd.	53, 55
D	
"Daily Herald"	52
Decca Navigator Co., Ltd., The	39
De Havilland Aircraft of Canada, Ltd.	49
De Havilland Aircraft Co., Ltd., The	27
De Havilland Propellers, Ltd.	21
Delaney Gallay, Ltd.	23
Derby Aviation, Ltd.	53
Dowty Equipment, Ltd.	22
E	
English Electric Co., Ltd., The (Guided weapons Div.)	41
F	
Fairey Aviation Co., Ltd., The	12, 54
Firestone Tyre & Rubber Co., Ltd.	36
Fletcher, C. W. & Sons, Ltd.	52
G	
Godfrey, Sir George, & Partners Ltd.	8B
H	
Handley Page, Ltd.	43, 55
Hawker Siddeley Aviation, Ltd.	Front Cover, 55
Houchin, Ltd.	10
Hunting Aircraft, Ltd.	55
I	
I.C.I., Ltd., (Plastics Division)	6
K	
Kidde, Walter Co., Ltd., The	8A
L	
Lancefield Aircraft Components, Ltd.	4
Latex Upholstery, Ltd.	52
Light Soldering Developments, Ltd.	54
Lodge Plugs, Ltd.	42
Lombank, Ltd.	30, 31
Lucas, Joseph (Gas Turbine Equipment), Ltd.	Back Cover
M	
Mallinson, Wm., & Sons, Ltd.	10
Marconi's Wireless Telegraph Co., Ltd.	26
Martin-Baker Aircraft Co., Ltd.	29
Microcell, Ltd.	38
Ministry of Transport & Civil Aviation	55
N	
Napier, D. & Son, Ltd.	24
Nord Aviation	Inside Back Cover
Northern Aluminium Co., Ltd.	46, 47
P	
Palmer Aero Products, Ltd.	1
Phillips & White, Ltd.	52
Plessey Co., Ltd., The	37
R	
R.F.D. Co., Ltd.	44
Rotax, Ltd.	Inside Front Cover
Rotol, Ltd.	20
Rubbaglas, Ltd.	56
Rumbold, L. A., & Co., Ltd.	50
Rye, Claude, Bearings	54
S	
Shell Aviation Services	45
Standard Telephones & Cables, Ltd.	8
Stream-Line Filters, Ltd.	11
Super Oil Seals & Gaskets, Ltd.	48
T	
Teddington Aircraft Controls, Ltd.	34
Thorn Electrical Industries, Ltd.	5
Titanine, Ltd.	9
U	
Ultra Electric, Ltd.	40B
V	
Vickers-Armstrongs (Aircraft), Ltd.	13—18
W	
Westland Aircraft, Ltd.	25
Wynn, E. D. (Aircraft), Ltd.	56

Printed in England and Published Weekly by the Proprietors, TEMPLE PRESS LIMITED, BOWLING GREEN LANE, LONDON, E.C.1.
Registered at the G.P.O. as a Newspaper. Second class postage paid at New York, N.Y.

AGENTS ABROAD—EUROPE—Messageries Dawson (S.A.), Paris; Messageries Hachette, et Cie, Paris; W. H. Smith & Son, Paris and Brussels. CANADA—Wm. Dawson Subscription Service Ltd., Toronto; Gordon & Gotch Ltd., Toronto. U.S.A.—Eastern News Co., 306 West 11th Street, New York, 14, N.Y. AFRICA—Central News Agency, Ltd., Cape Town; W. Dawson & Son (S.A.), Cape Town. ASIA—W. Thacker & Co., Ltd., P.O. 100 Bombay. AUSTRALIA and NEW ZEALAND—Gordon & Gotch (A'sia), Ltd.

NORD-AVIATION

MANUFACTURER OF ANTI-TANK MISSILES
SS.10 - SS.11



TARGET DRONE

CT.20

2 A 18, RUE BERANGER
CHATILLON-SS-BAGNEUX
(SEINE) TÉL. ALÉSIA 57-40

One advertisement in a series of nine

LUCAS RESEARCH

THE LUCAS Research Laboratories are equipped with the latest facilities for conducting metallurgical research. Shown here, for example, is the *Thermal Fatigue Test* which is used to determine the effect of rapid temperature changes encountered by certain sheet metal parts of gas turbines during flight.

Other facilities include *Creep Testing* equipment for the measurement of creep of metals at temperatures, and *Fatigue Testing Machines* for determining the fatigue properties of materials up to 900°C.

In addition, there is a *Vibration Laboratory* where the vibration characteristics of light engineering structures can be determined and endurance testing carried out.

FUEL & COMBUSTION SYSTEMS FOR GAS TURBINE & RAM JET ENGINES; HYDRAULIC SYSTEMS

JOSEPH LUCAS (GAS TURBINE EQUIPMENT) LTD., Birmingham & Burnley.
LUCAS-ROTAX (AUSTRALIA) PTY. LTD., Melbourne & Sydney, Australia.
LUCAS-ROTAX LTD., Toronto, Montreal and Vancouver, Canada.

LUCAS